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From the Publisher

THE appearance of this issue of the JOURNAL marks the completion of its first year of publication. With each issue the subscription list has jumped gratifyingly. But this is not to say that the JOURNAL has achieved a "popular" circulation, and it is perhaps not likely that this can ever be achieved until the history of medicine becomes a discipline taught wherever medicine is taught.

When the publication of the JOURNAL was in the formative stage, the editors and publisher visualized it as a positive and dynamic factor in stimulating interest in the history of medicine and allied subjects. We were convinced that there was a growing potential audience for these subjects, and we believed that an important function of the JOURNAL was to provide a medium for an adequate expression of that interest.

We can now report that the JOURNAL has been outstandingly successful in reaching a much greater portion of this potential audience than was anticipated. An evidence of the impression made by the JOURNAL outside of the United States has been the readiness on the part of the British publishing house, Wm. Heinemann Medical Books, Ltd., to publish the JOURNAL under their own imprint for the Eastern Hemisphere. But the goal of the JOURNAL is to achieve a broader audience, an audience deserving of the subject, and one that will be more widely representative of *all* the medical profession as well as the ranks of historians.

One recalls the advice of Oliver Wendell Holmes who urged physicians not to look with contempt on their old medical books (read: history of medicine); for, said he,

> The debris of broken systems and exploded dogmas form a great mound, a Monte Testaccio of the shards and remnants of old vessels which once held human beliefs. If you take the trouble to climb to the top of it, you will widen your horizon, and in these days of specialized knowledge, your horizon is not likely to be any too wide.

We turn hopefully to supporters of the JOURNAL for cooperation in furthering its growth, not only by contributing to its pages, but by—quite plainly—helping to enlarge steadily its subscription rolls.

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Surgical Anesthesia, 1846-1946

JOSIAH CHARLES TRENT*

IN THIS year we celebrate the centenary of the discovery of surgical anesthesia. For only one hundred years has man known the benefit of painless surgery, yet the concept has become so firmly established in our minds that we now think of anesthesia not as a refinement in surgery, but as the indispensable accompaniment of even the most minor surgical operation. Few, even among surgeons themselves, are able to conceive of operating without the use of anesthetics: we are bred to the practice as to the aseptic technique, and only the most extraordinary circumstances could bring us to dispense with either. In order to appreciate fully the tremendous significance of the introduction of anesthesia, we must for a moment abandon our modern attitude of taking anesthesia for granted, and attempt to visualize the conditions which existed in operating rooms before its introduction.

The spectacle cannot be regarded without emotion. The patients were few in number, for the fear of pain was a deterrent equally as strong as the fear of possible accidents or of fatal errors by the surgeon; many preferred to die rather than endure the exquisite agony which was in store for them. Once brought to the table, they responded to the ordeal in various ways: some struggled and screamed without remission, begging the surgeon to leave off or to make haste; some, usually the feeblest, fell into a trance-like state, which favored the progress of the operation but gave little promise of survival; some bravely made no sign of suffering at all. Some cursed, some prayed, few wept or fainted:

> I asked a man once after an amputation if he felt faint during the operation. His reply was very curious and characteristic. "Did I feel faint? What a question to ask! Did I feel faint? Why of course I didn't. Neither would you if you had the same reason to keep you from fainting. It was a good deal too bad for that."[1]

For all patients the experience entailed severe nervous shock and a long period of depression to follow, conditions which interfered seriously with the healing of operative wounds and greatly protracted convalescence. Sir Benjamin Richardson wrote: "I have heard many express that if they

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[1] Sir Benjamin Ward Richardson, *Vita Medica: Chapters of Medical Life and Work* (London 1897) 82.

had known beforehand what the suffering was, and the effects subsequently endured, they would rather have faced death than such a fearful struggle for continued existence."[2]

While we pity the patients of the days before anesthesia, we must not forget that for surgeons also operating was a terrible ordeal. As students they had to learn to harden themselves to the spectacle of pain. The lesson was a difficult one: it is told of Sir James Young Simpson that "after seeing the terrible agony of a poor Highland woman under amputation of the breast, he left the class-room and went to the Parliament House to seek work as a writer's clerk."[3] Callousness did not always come with years of experience; for many accomplished surgeons the morning of operating-day regularly brought anxiety and dread. The necessity for inflicting such pain seemed hard indeed to humane men; there was always the chance, too, that the agonized writhing of the patient might lead to some fatal slip. Valentine Mott wrote:

> How often, when operating in some deep, dark wound, along the course of some great vein, with thin walls, alternately distended and flaccid with the vital current —how often have I dreaded that some unfortunate struggle of the patient would deviate the knife a little from its proper course, and that I, who fain would be the deliverer, should involuntarily become the executioner, seeing my patient perish in my hands by the most appalling form of death![4]

The presence of pain was, moreover, an insuperable barrier to the development of surgery as a science. Time was at a premium for the operator; he must have accurate anatomical knowledge, to be sure, and coolness and presence of mind, but, most of all, to be successful he must have great manual dexterity. The operations devised, the techniques employed, must fit with the requirement of speed. Operations were few in number and limited in kind, partly because of the reluctance of the patients, partly because surgeons themselves considered the knife their last resort, to be employed only after the most detailed conservative measures had failed. During the five years preceding the introduction of anesthesia, only 184 operations—three per month—were performed at the Massachusetts General Hospital; these were chiefly confined to the surface of the body, including excision of tumors, amputation of limbs and breasts, various plastic operations, and herniotomy.[5] Conditions were similar elsewhere: in 1844–1845, the British surgeon Robert Liston operated in "five

[2] *Ibid.*

[3] J. Duns, *Memoir of Sir James Y. Simpson, Bart* (Edinburgh 1873) 27.

[4] Valentine Mott, *Pain and Anæsthetics* (2nd ed., Washington 1863) 11.

[5] J. Collins Warren, *The Influence of Anæsthesia on the Surgery of the Nineteenth Century* (Boston 1906) 26.

cases of lithotomy, four of herniotomy, and one of perineal section for laceration of the urethra" and in several cases of phimosis, fistula *in ano*, and extravasation of urine; he excised tumors in 22 cases, including a large ovarian tumor; he performed ten amputations, one excision of a joint, one ligation for aneurism of the femoral artery, three subcutaneous and a number of plastic operations.[6] A limited program, certainly, for one of the most popular and skillful surgeons of the day, yet, save for a few established operations, Liston had no precedent for invading the three internal cavities. Trephining of the skull is a practice older than history; drainage for empyema is mentioned by Hippocrates; lithotomy, herniotomy, ovariotomy, and reparatory measures in cases of traumatism were the sole accepted excuses for entry into the abdominal cavity. Surgical diagnosis was severely hampered, since the barbarity of an exploratory incision was unthinkable. Great operations were planned and executed upon cadavers, but pain forbade their use in actual practice.

With pain thus standing inexorably in their path, it is not surprising that surgeons through the centuries should have endeavored to find some means of alleviation.[7] The story of anesthesia has a long foreground, beginning in prehistoric and classical times with the use of various drugs to induce sleep and deaden pain. Other methods were attempted: the compression of nerves and vessels adjacent to the operating field, the application of cold, intoxication of the patient, mesmerism, bleeding to the point of syncope. The true thread of the story appears in 1772 with Priestley's discovery of nitrous oxide gas. The effect of this gas in producing insensibility and its possible value in surgical operations was first pointed out in 1800 by Humphry Davy. Next Michael Faraday, in 1818, noted the soporific effects of the vapor of sulphuric ether. Six years later, Henry Hill Hickman conducted a series of experiments with carbon dioxide gas on animals, proving the feasibility of abolishing surgical pain by the prior administration of a gas. In January 1842, an American dentist, Elijah Pope, painlessly extracted a tooth from the jaw of a patient to whom ether had been administered by William E. Clarke. Two months later, Crawford W. Long, a Georgia physician, began the practice of administering ether before performing the minor surgical operations which came his way. In 1844, Horace Wells, a dentist of Hartford, Connecticut, employed nitrous oxide gas in tooth-extraction and vainly endeavored to

[6] J. Marshall, "A Forty Years' Retrospect," *Brit. Med. Jour.* 2 (1885) 238.

[7] For many of the facts included in the following paragraph, I am indebted to Thomas E. Keys, *The History of Surgical Anesthesia* (New York 1945) 3–27.

convince surgeons of its value. And finally, on the sixteenth of October, 1846, in the operating room of the Massachusetts General Hospital, the time, the place, and the men conjoined. From the jaw of Gilbert Abbott, unconscious after inhaling ether administered to him by William T. G. Morton, Dr. John C. Warren excised a tumor "without any expression of pain on the part of the patient." The news of this event and of the subsequent painless operations performed at the same hospital spread to all parts of the world, and surgical anesthesia became an accomplished fact.

The hypotheses and experiments of many men preceded Morton's demonstration. It is but just to admit that others anticipated his discovery of the principle of anesthesia; some—Hickman, Wells, and Long—realized fully its significance for surgery. Most great innovations are similarly anticipated: our world is conservative and discourages new beginnings. False starts and fruitless efforts cumulate through the years. Then the appointed hour comes and with it a man eager and able to drive the new truth home to the unwilling minds of men. Such was Morton's accomplishment.

Many words have been wasted upon the ether controversy during the past hundred years. Of late, however, some historians have come to disregard the vexed question of priority and to interest themselves rather in the development of anesthesia: its introduction into various countries, its influence upon surgical practice, the emergence of its various branches. The articles in the present issue of the JOURNAL are principally concerned with aspects of these topics, which may well be briefly surveyed here.

The first official account of Morton's etherization experiments to reach the public was a memoir read by Henry Jacob Bigelow before the American Academy of Arts and Sciences on the third of November, 1846. On November 7, Dr. George Hayward successfully amputated the limb of an etherized patient, and Bigelow

> incorporated this confirmatory evidence into a second paper read before the Medical Improvement Society of [Boston on November 9]. This paper, afterwards published in [the *Boston Medical and Surgical Journal*], was the first upon the subject, and was, I believe, that which carried the news to the South and across the Atlantic.[8]

The article to which Bigelow here refers, his "Insensibility During Surgical Operations Produced by Inhalation," was published in the *Boston Medical and Surgical Journal* of November 18, 1846 (Fig. 1). By this time

[8] Henry Jacob Bigelow, *Surgical Anæsthesia: Addresses and Other Papers* (Boston 1894) 31.

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FIG. 1. The title-page of the *Boston Medical and Surgical Journal* for November 18, 1846, containing the first published report on Morton's ether demonstration.

Boston surgeons were more or less thoroughly convinced of the utility and efficacy of etherization. New York was not far behind. On the twentieth of November, Dr. Horace Kimball, a New York dentist, gave Dr. A. L. Cox a copy of the Boston journal containing Bigelow's report.[9] Cox arranged to have Kimball etherize a patient on whom he was to operate the next day; unfortunately Kimball was unable to secure for the occasion the only ether-inhalation apparatus then available in New York. On the fourth of December Kimball, having become the agent of the patentees for New York and having secured the necessary apparatus, demonstrated its use in the case of "a young lady from Brooklyn," whose enlarged tonsils were then removed by Dr. Cox with little or no pain to the patient. Dr. Cox was equally successful in several other minor operations, but the true acceptance of etherization in New York City apparently came on the eighth of December, when the distinguished Dr. Valentine Mott removed a cluster of tumefied glands from the right axilla of a patient, whose sufferings were "in part averted entirely, while the rest was greatly mitigated" by etherization.

Quite different from the willing reception of ether in New York was that accorded by Philadelphia. The immediate response of the profession in the latter city to Bigelow's article was highly critical, accusing Boston physicians of sponsoring charlatanry; acceptance of anesthesia was slow and grudging. As late as 1850 it was possible for a writer in the *Medical News and Library* to remark, with misguided pride, of the Pennsylvania Hospital: "anæsthetic *agents have never been used at a single surgical operation in that* institution."[10] Apparently, however, half-hearted tests of etherization had been conducted. An amusing anecdote concerning one such fiasco has been preserved. Shortly after Morton's discovery, Dr. George W. Norris, prior to amputating a crushed leg, asked a resident physician, James Darrach, to get some ether and administer it to the patient. Darrach complied and was horrified to see the man lose consciousness. "He called to Dr. Norris: 'Sir the man is unconscious!' and Dr. Norris yelled to him: 'Take that damned stuff away, Darrach.'"[11] It is recorded that in May, 1847, Dr. William Gibson, then Professor of Surgery at the University of Pennsylvania Medical School, amputated the finger of a medical student under ether.[12]

[9] A. L. Cox, "Experiments with the Letheon in New York," *Boston Med. Surg. Jour.* 35 (1846) 456–59.

[10] *Med. News and Libr.*, Phila., 8 (May 1850) 38.

[11] Francis R. Packard, *Some Account of the Pennsylvania Hospital from Its First Rise to the Beginning of the Year 1938* (Philadelphia 1938) 43–44.

[12] Richard Manning Hodges, *A Narrative*

The Cunard steamer *Acadia*, sailing from Boston on the third of December, 1846, carried a letter from Dr. Jacob Bigelow to Dr. Francis Boott of Gower Street, Bedford Square, London. In his letter Bigelow announced the discovery of etherization and remarked briefly on its significance, enclosing a *Boston Daily Advertiser* containing extracts from his son's article.[13] The *Acadia* had reached Liverpool by the sixteenth of the month, and Boott received the letter in due course. He promptly made arrangements with a neighboring dentist, James Robinson, to test the powers of ether. On Saturday, December 19, at Boott's house Robinson successfully administered ether to a Miss Lonsdale and extracted a molar tooth from her jaw. Several subsequent trials were made, apparently on the same day, all proving unsuccessful because of a defect in the valve of the apparatus employed. Robert Liston attended one of these attempts and immediately set about securing a more efficient inhaler; with the help of William Squire, Liston's assistant, and Peter Squire, the chemist, a suitable apparatus was devised.[14] On Monday, December 21, at the University College Hospital Liston operated on two etherized patients, performing evulsion of a great toenail and amputation of a thigh. The entire success of these trials was sufficient to secure anesthesia a fair hearing in England, where the practice spread rapidly.

In France the introduction of ether occurred under less propitious circumstances. Dr. Francis Willis Fisher of Boston, then studying in Paris, was informed of the discovery in December.[15] After failing in an initial attempt to persuade Velpeau to try etherization on his operative cases, Fisher experimented on himself without success. On December 15, he gave ether at the St. Louis Hospital to a patient of Jobert de Lamballe, also unsuccessfully. By January 12, 1847, however, Malgaigne had performed at the same hospital four operations on patients under ether; on January 23, Fisher, using a "Boston Inhaler" successfully administered ether for an operation by Roux, while on the same day Velpeau operated

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of Events Connected with the Introduction of Sulphuric Ether into Surgical Use (Boston 1891) 60.

[13] Francis Boott, "Surgical Operations Performed during Insensibility, Produced by the Inhalation of Sulphuric Ether," *Lancet* 1 (1847) 5–8.

Francis Boott (1792–1863) was born in Boston and educated at Harvard University; he spent several years thereafter in travelling between England and America, making lifelong friendships in both countries. He took his M.D. at Edinburgh in 1824, practiced successfully in London for about seven years, then retired and devoted himself to literary and scientific studies (*D.N.B.* 2. 855).

[14] William Squire, "The First Operation under Ether in Great Britain" *Brit. Med. Jour.* 2 (1896) 1143.

[15] F. Willis Fisher, "The Ether Inhalation in Paris," *Boston Med. Jour.* 36 (March 1847) [109]–113. See also below, p. 607.

on an etherized patient at La Charité. In May of that year Henry Bryant remarked in a letter from Paris that during his month's stay there he had heard no allusion to the discovery of ether anesthesia: "It has taken its rank among medical agents, and is as quietly and firmly established as if it had been known for centuries."[16]

Thus the practice spread, with almost universal acclaim. The most immediate effect of the introduction of ether anesthesia was a change in the attitudes of both surgeons and patients toward operating: anesthesia brought not only abolition of pain, but also greater safety during the operation, greater readiness in healing. As a result, there was a rapid increase in the number of operations performed. As early as April of 1847, an editorial in *The Lancet* remarked: "the number of surgical operations in some of our hospitals has been more than *doubled* since the introduction into practice of the use of ETHER-VAPOUR."[17] During the five years following the Morton demonstration, the number of operations at the Massachusetts General Hospital increased to 487 as against 184 of the preceding five years.[18] The vast increase in the number of cases seen at the operating table facilitated the development of surgical diagnosis and favored the growth of the surgical specialties, plastic surgery, ophthalmology, and urology, in particular. For some years surgeons confined themselves to established techniques; then, gradually, new occasions for surgical intervention were found, and the thorax, abdomen, and skull were more and more freely invaded. Although surgery could not achieve its full triumph until Lister's establishment of the antiseptic principle, the science made greater strides in the twenty years after anesthesia than in the twenty centuries before.

Not only the nature of surgery, but also the qualifications for its practice changed. Manual dexterity and speed ceased to be prime desiderata in surgeons, deliberate and careful techniques took their place, and many able men rose to eminence despite their lack of mere mechanical talents. As Lawson Tait remarked of Syme: "He never could have been the surgeon he was without the encouraging influence of an anæsthetic."[19]

While working these many changes in surgery, anesthesia itself was far from static. Once its practicability had been demonstrated, attention was turned to the discovery of new drugs with anesthetic properties, for ether although effective was malodorous and irritant. In November 1847, just

[16] Henry Bryant, "Inhalation of Ether in Paris," *Boston Med. and Surg. Jour.* 36 (1847) [389].

[17] *Lancet* 1 (1847) 392.

[18] J. Collins Warren, *loc. cit.* (see note 5).

[19] Lawson Tait, "Surgical Training, Surgical Practice, Surgical Results," *Brit. Med. Jour.* 2 (1890) 270.

one year after the first report of ether anesthesia, Sir James Y. Simpson announced the introduction of a new drug, chloroform, thought to possess all the advantages and none of the disadvantages of ether. This was but the first of hundreds of anesthetic agents which have been introduced during the past century. Among the most important of these are morphine (Sertürner, 1808; Lafargue, 1836), cocaine (Gaedicke, 1855; Niemann, 1860; Bennett, 1873), procaine and its compounds (Einhorn, 1904), the barbiturates (Fischer, 1902), ethylene (Nunneley, 1849; Luckhardt and Carter, 1923), avertin (Eichholz, 1917; Butzengeiger, 1926), and cyclopropane (Freund, 1882; Lucas and Henderson, 1928; Waters and colleagues, 1934).

Early in the history of surgical anesthesia the emphasis was upon the open administration of ether and chloroform, but as other drugs with special properties became available special techniques were of necessity developed. In 1884 Carl Koller of Vienna first used cocaine topically in the eye. In 1885 James Leonard Corning injected cocaine in or around the spinal canal, producing "spinal" anesthesia.[20] Halsted (1885) and Cushing (1902) developed infiltration and nerve-block anesthesia. Intravenous anesthesia has of late become clinically important through the use of two rapidly acting barbiturates, evipal and pentothal. Rectal anesthesia came to the fore with the introduction of avertin in 1926. The youngest of the surgical specialties, thoracic surgery, has actually been made possible by the development of endotracheal "positive pressure" anesthesia.

The anesthetist's armamentarium now includes complex apparatus and numerous accessory drugs, which are used to facilitate smooth and effective anesthesia. Increasing knowledge of the physiology of respiration has led to the invention of elaborate machines to permit a "closed" system, in which the gases are conserved and the exhaled carbon dioxide is absorbed. Morphine and many of the barbiturates are no longer used to induce anesthesia but are valuable as sedatives preoperatively. Even curare, once considered a deadly poison, has been used as an aid to relaxation during anesthesia.

The literature of anesthesia has become so vast and specialized that many journals devoted entirely to this subject have appeared. The science of anesthesia has progressed to such a point that its proper application demands the services of trained anesthesiologists. To meet this need, more and more residencies in anesthesia are being made available. In 1937, in

[20] This has culminated in the recently perfected practices of continuous spinal and continuous caudal anesthesia.

the United States, a board of anesthesiology was established as an affiliate of the American Board of Surgery; in 1941 an independent board was instituted to pass upon the qualifications of persons trained in the field. All these developments give promise that the future of anesthesia will bring achievements even greater than the tremendous advances of the past one hundred years.

Some Anesthetics of Antiquity

G. KASTEN TALLMADGE*

PAIN kills, and deadens the will of the sufferer to live. At the beginning of historic time man is found seeking means to abate the fatal edge of pain. The history of anesthesia, then, begins not with the first trial of diethyl ether in human narcosis, nor yet with the trial of "the sweet oil of vitriol" by Valerius Cordus and Paracelsus, but at the first use of the poppy, the mandragora, the hyoscyamus, and alcohol, in the mitigation of human pain.

In Homer one reads:

> She [Helen] cast into the wine of which they were drinking a drug to quiet all pain and strife, and bring forgetfulness of every ill. Whoso should drink this down, when it is mingled in the bowl, would not in the course of that day let a tear fall down over his cheeks, no, not though his mother and father should lie there dead, or though before his face men should slay with the sword his brother or dear son, and his own eyes beheld it. Such cunning drugs had the daughter of Zeus, drugs of healing, which Polydamna, the wife of Thon, had given her, a woman of Egypt, for there the earth, the giver of grain, bears greatest store of drugs, many that are healing when mixed, and many that are baneful; there every man is a physician, wise above human kind, for they are of the race of Paeëon.

The ingredients of the potion are unknown, of course. Perhaps one of them was that same lotus which hypnotized with Lethean forgetfulness the navigators of Odysseus, a fruit which has been variously identified with that of the African jujube tree (*Zizyphus lotus*), of a somewhat similar tree (*Rhamnus lotus*), of the nettle-tree of southern Europe (*Celtis australis*), and of other trees and shrubs. But the fruits of any of these, and the wines which men have made from their juices, are not the nepenthe of the Lotophagi.

The physicians of Cos and Cnidus and Crotona, in the fifth century before Christ, classified their drugs according to their effects, judging the effects by the requirements of the humoral or another theory. A whole group, and often a surprisingly numerous group, of medicinal substances was comprised in the emetics, the laxatives, the exsiccants, or the calefacients. Among these was also the group of the refrigerants, which included all those drugs known to be, or thought to be, or perhaps only hoped

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to be, anodyne, soporific, anesthetic, or narcotic. They were named *frigidi, frigidiores,* and *frigidissimi,* according to the intensity with which they possessed these qualities. Thus hyoscyamus, being narcotic, was called *herba frigidissima.* Wild lettuce (*Lactuca silvestris*), on the other hand, was called *herba temperate frigida,* since it was only slightly "cooling"—that is, analgesic and soporific. As the science of materia medica advanced, attempts were made to grade the intensity of action of drugs somewhat more accurately. Thus hyoscyamus was graded by Platearius: *frigide complexionis est in tertio gradu, siccus in secundo.*

Apart from preventing an incalculable quantity of sheer human suffering, surgical anesthesia reduces surgical mortality, makes it possible for the surgeon to operate more skillfully, and allows him to perform operations which otherwise he would hardly attempt. The impairment of surgical technique made by the sufferings of the conscious patient was well known to Celsus:

> A Chirurgeon must have a strong, stable, and intrepid hand, and a mind resolute and merciless; so that to heal him he taketh in hand, he be not moved to make more haste than the thing requires; or to cut less than is needfull; but which doth all things as if he were nothing affected with their cries; not giving heed to the judgment of the vain common people, who speak ill of Chirurgeons because of their ignorance.[1]

The drugs used as anesthetics before the modern period were, principally, the poppy, the hyoscyamus, and the mandragora.

Poppy

Somno vero aptum est papaver, wrote Celsus, and this fact had been known, it appears, from immemorable time. The stem, the leaves, the seeds, and the juice were used, but above all the *lacrimae*—tears. The tears were produced as they are today still, by cutting or scratching the unripe seed pod, and later gathering in a shell the drop of sap which had exuded and had dried in the sunshine. Poppy was known to produce sleep, to relieve cough, to stop the bowels, and to alleviate pain, and on the last score it was employed medically in very many diseases. The sleep it caused was described by most writers in Virgil's word, Lethean. Moreover, poppy was known to produce, in adequate doses, lethargy and death.

Celsus had several formulas for anesthetic pills containing poppy.

Those pills which alleviate pain by causing sleep are called anodynes in

[1] Celsus, VII, pref., tr. by Thomas Johnson (1649).

Greek. It is bad practice to employ them except in cases of urgent necessity, for they are compounded of powerful drugs and are bad for the stomach. However, one may be used, which contains a denarius [about 3i] each of tears of poppy and galbanum, and two denarii each of myrrh, castoreum, and pepper. It is enough to swallow a piece the size of a bean.

And again:

Take a handful of poppy when it is ripe for taking its tears, put it into a vessel, add enough water to cover it, and cook it. When it is well cooked, squeeze out the mass of poppy into the vessel before discarding it, and mix with the fluid an equal quantity of raisin wine. Boil it until it thickens, then cool it and make it into pills about the size of domestic beans.

They have many uses. They induce sleep, whether taken alone or dissolved in water. Added, in small quantity, to the juice of rue, or to raisin wine, they stop ear-ache. Dissolved in wine, they stop colic. Mixed with beeswax and attar of roses, and with a little saffron added, they cure inflammation of the vulva; and dissolved in water which then is applied to the forehead, they stop running of the eyes.

In the same way, if a painful vulva prevents sleep, take two denarii of saffron, one each of anise and myrrh, four of poppy tears, eight of hemlock seeds, and mix them into a paste by adding old wine. The dose is a piece the size of a lupin, dissolved in three glasses of water. But it is dangerous to administer when fever is present.

Tears of poppy—opium, in fact—were well known, of course, and opium is mentioned in a thousand places, by Dioscorides, Athenion, Heracleides of Tarentum, and Galen, by the Salernitans, Paré, Fabricius, and the rest. Gilbert of England wrote this potent prescription:

℞ seminum papaveris albi et nigri,
seminum lactucæ (wild lettuce) āa ℥j;
opii,
meconii, āa ℈j vel ij, whichever is needed.
This should be given when an operation must be performed, until the patient sleeps. After the operation, to awaken the patient, soak a sponge in vinegar and rub his teeth and nostrils with it, and put a little vinegar into his nostrils.

These men knew what narcotics were. Heroic doses were needed to produce a narcosis sufficiently deep for surgical operations, and sometimes no doubt the vinegar failed.

Hyoscyamus

Hyoscyamus was called a soporific, was known to be extremely poisonous, and was considered dangerous because of the lack of uniformity in its toxicity from patient to patient. It was used to kill dogs and mice. It was

used also, according to Dioscorides, to catch birds: a quantity of it was burned beneath the tree where the birds nested; those which inhaled the smoke would fall to the ground senseless, and though some perished, others could be revived by dropping vinegar into their nostrils.

Three kinds of hyoscyamus were recognized, the white, the red, and the black. The white was used medicinally, and if it could not be had, the red might be substituted. The black, however, was said to be too poisonous for human use.

The seeds were used by preference, and they were to be collected only during the dog days. Celsus used hyoscyamus for the mitigation of toothache. Dioscorides was well aware of its toxicity: "If it is drunk or eaten, it causes that kind of insanity, or turbulent counterfeit of sleep, which the layman calls 'milimundrum,' for it produces alienation of the mind." Platearius—or whoever was the author of the work called *Circa Instans*—said of hyoscyamus, "It has the power of constricting, killing, and bringing sleep."

Hyoscyamus generally was combined with opium, and, though empirical, the combination was, of course, less toxic than either drug used alone, albeit no one seems to have noticed this.

MANDRAGORA

"Give me to drink mandragora!" cried Shakespeare's heroine from the depths of her woe, and it was used by the surgeons of Rome, for one finds it mentioned by Pliny as a surgical anesthetic. Celsus and Dioscorides recommended it for relief of toothache, and Celsus also for surgical anesthesia in combination with hyoscyamus: "Another anodyne, worse for the stomach but more soporific than the tears of the poppy, is compounded of an eighth of a denarius of mandragora and four denarii each of parsley seed and hyoscyamus seed; these are rubbed together with wine, and it is enough to swallow a piece the size of a small bean." Dioscorides wrote of mandragora, "It is a herb whose rind, mixed with wine, is given to drink to those whose cure must be surgical, so that they will fall asleep and feel no pain. . . . For it assuages pain and puts an end to sleeplessness."

The rind of the root was preferred; next, the apple; and finally, the leaves. Its potency was well recognized, for it is called, almost universally, *frigida et sicca in quarto gradu*. It, also, was combined with other drugs, as, for example, in this prescription by Celsus:

But for headache, ulcers, ophthalmia, toothache, dyspnœa, or for griping or

inflammation of the vulva, hip, liver, or spleen, or for a side-ache, or if rest is disturbed by disease of any part of the body, this pill will quiet pain: ochre, sweet flag, rue seeds, two denarii of each; tears of poppy, panax root, dried mandragora apples, and the flowers of the round bulrush, two denarii of each; and fifty-six grains of pepper. These are bruised separately, and then ground together, adding a few drops of raisin wine from time to time until the mass has the consistency of a thick paste. A little may be eaten, or it may be diluted with water and drunk.

Mandragora was used commonly for surgical anesthesia for many centuries, and was especially favored in the thirteenth century by Hugo, the celebrated surgeon of Lucca. Gilbert of England, characteristically heroic in his use of drugs, gave a *confectio soporifica*:

℞ opii,
succi hyoscyami,
succi (vel seminum) papaveris nigri,
succi (vel corticis, vel pomorum) mandragoræ,
foliorum hederæ arboris,
succi mororum ruborum maturorum,
seminum lactucæ silvestris,
succi cuseutæ (dodder-weed), āa ℥j.
Mix in a copper vessel, set it in the sun during the dog-days, put in a sponge to take up the juice, and then leave the sponge in the sun until it is dry. When an operation must be done, hold the sponge over the patient's nose and mouth until he is asleep; then the operation may be commenced.

After the operation, the patient was awakened (one hopes) by the use of vinegar as described before.

This prescription, however, introduces to us two other drugs which were used as narcotics also, morum (or, indiscriminately, morus) and lactuca—the mulberry and wild lettuce, respectively.

Lactuca (Wild Lettuce)

The wild lettuce (*Lactuca silvestris*) was called a refrigerant by all the ancient physicians, and was used as a soporific. The juice, or "milk," of the stem was preferred, and was active only if collected when the plant was mature, as Celsus noted: "Lactuca somno vero apta est, maxime æstiva, cuius cauliculus iam lacte repletus est." Dioscorides used the milk alone, to be drunk, as an efficient soporific. Today one would not wish to undergo a surgical operation under the anesthesia of lettuce-juice, and it was not long before it was used only as an adjuvant to other drugs. During the Renaissance the seeds were preferred to the juice. Platearius of Salerno wrote, "For producing sleep, the seeds are made up with human

milk and egg-white, into a plaster, which is placed about the temples; or the seeds, powdered, may be given in milk, and this will cause sleep."

Morum (Mulberry)

"Somno vero aptum est morum," wrote Celsus. This mulberry is a species of hemp (*Cannabis*), and we know from Herodotus that the Scythians practiced the custom of inhaling the fumes of a kind of hemp to produce intoxication. A preparation of hemp is said to have been used by the illustrious Chinese surgeon, Hoa-tho, in the third century of the Christian era, as a surgical anesthetic. The mulberry was in common use in the medicine of the Western world, but *Cannabis indica* seems to have enjoyed, in comparison, a very small reputation as a refrigerant and soporific.

Episodes in the History of Anesthesia

EMMET F. HORINE*

THIS centennial year (1946) of the demonstration of the use of ether in surgery at the Massachusetts General Hospital will probably witness the rekindling of the controversy concerning priority. The partisans of the various claimants are apparently ever on the alert to reassert their positions.

The idea of relief from the pain of surgical procedures is undeniably of great antiquity, and no one of the modern contenders can claim to be the originator of this basic concept. In 1846, however, sulphuric ether, which had been known, though little used, for centuries, was demonstrated to be relatively safe as an agent for the alleviation of the pain of operations. Its widespread use soon followed. The fact that the controversy concerning the discovery of the anesthetic properties of ether attracted so much attention in newspapers as well as in scientific publications undoubtedly contributed to the rapid popularization of its use.

As to the terms describing the effects of ether, Oliver Wendell Holmes wrote Morton on November 21, 1846, suggesting the use of the noun *anaesthesia* and the adjective *anaesthetic*.[1] Holmes deserves credit for the independent coinage of these words from his knowledge of Greek. It is not generally known, however, that priority in the use of the word *anaesthesia* in its modern connotation belongs to Dioscorides (first century A.D.). In describing one of the effects of mandragora,[2] the word ἀναισθησία is used exactly as it would be used today:

> And some boil down in wine the roots into a third and having strained out they store away: using one cyathus upon those being sleepless and those in great pain and upon whom they wish to produce anesthesia while being cut or cauterized.

In addition to mentioning the internal administration of mandragora, Dioscorides states that similar effects may be secured by its use in the form of a suppository or by rectal injection. Thus, not only did Dioscorides mention general and rectal anesthesia but, in discussing the effect of the powder obtained from the stone of Memphis, he described local anesthesia.[3]

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[1] E. Warren, *Some Account of the Letheon: or Who is the Discoverer* (3rd ed., Boston 1847) 84–85.

[2] Dioscorides, *Libri Octo Graece et Latine* ([Ed. Jacob Goupyl,] Paris 1549) leaf 219.

[3] *Ibid.*, leaf 312.

It is narrated that having been beaten small and smeared upon the places about to be cut or cauterized it produces anaesthesia without danger.

Therefore it is apparent that from the time of Dioscorides, physicians knew of the availability of mandragora for anesthetic purposes. Through the centuries there are occasional references to the fact that various agents may relieve the pain of operation; but the consensus seems to have been that these agents endangered the life of the patient. This may easily account for the infrequency of their use.

In an exhaustive study of mandragora,[4] Dr. Charles B. Randolph has called attention to the fact that Serapion (ninth century A.D.) and Avicenna (980–1037) went a step further than Dioscorides in that they had "personal knowledge" of its use as an anesthetic. Dr. Randolph does not doubt that the ancients were able to produce true anesthesia with mandragora. In proof of this he refers to the work of Benjamin W. Richardson, who secured specimens of the roots of mandragora from Greece and followed the exact technique described by the ancients in obtaining a vinous tincture. With this preparation he succeeded in producing an anesthetic state in animals and became convinced that "the wine of mandragora is a general anaesthetic of the most potent quality."[5]

For centuries alcohol and alcoholic preparations were employed prior to the reduction of dislocations and fractures as well as before operations. These drugs were not potent enough to relieve pain materially unless given in extremely large quantities, and they sometimes produced alarming symptoms. Dr. Philip Syng Physick (1768–1837) recommended the use of intoxicating amounts of alcoholic preparations for the purpose of relaxing the muscles before manipulative procedures in dislocations.[6] This plan had definite value as evidenced by a case[7] communicated to Dr. Charles Caldwell (1772–1853) by Dr. Simeon A. Dudley of Winchester, Ky. Early in December, 1818, Dudley was consulted by a patient who had a "downward dislocation of the humerus" of eight weeks duration which had resisted the efforts at reduction of a number of physicians previously consulted. The patient was an alcoholic, and Dudley conceived the idea of deliberately inducing "deadly intoxication" in order to secure muscular relaxation. The symptoms described were those apparently of deep anes-

[4] C. B. Randolph, "The Mandragora of the Ancients in Folk-lore and Medicine," *Proc. Amer. Acad. Arts Sci.* 40 (1905) 487–537.

[5] *Ibid.* 527.

[6] J. S. Dorsey, *Elements of Surgery for the Use of Students* (2 vols., Philadelphia 1813) 1. 204.

[7] C. Caldwell, "A Case of Luxation Downward of the Os Humeri" (describes with comments Dr. A. S. Dudley's case) *Phila. Jour. Med. Phys. Sci.* 1 (1820) 417–19; see also C. Caldwell, in *Nat. Gaz. Lit. Reg.* 1 (Feb. 21, 1821) p. 4, columns 2–3.

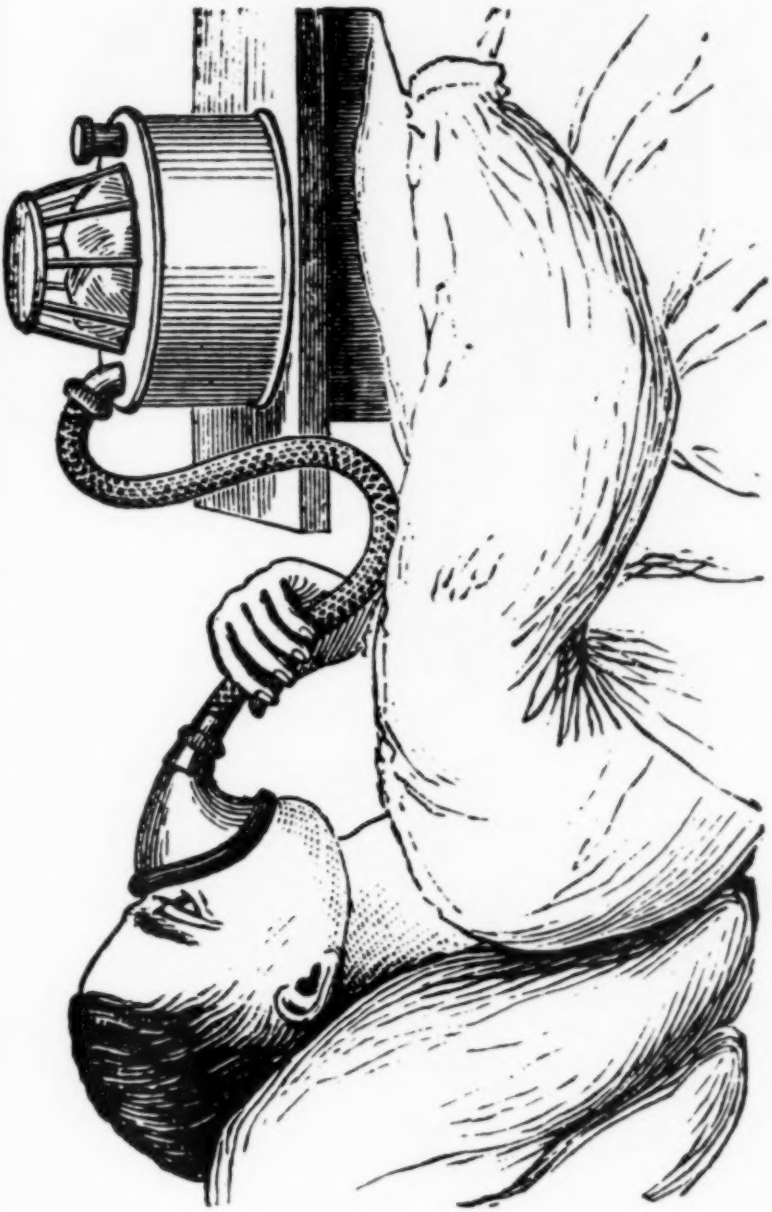

FIG. 1. The Morgan ether inhaler, 1872.

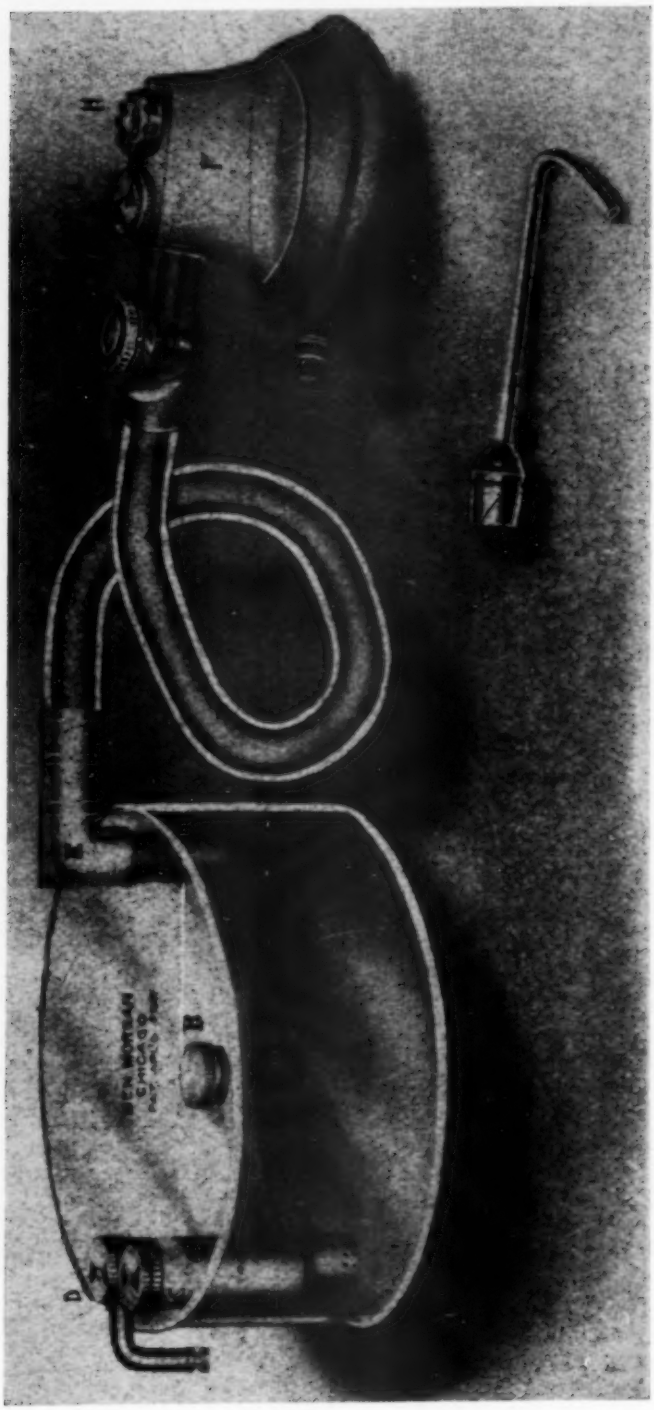

FIG. 2. The Morgan ether inhaler, 1915.

thesia which alarmed the physician and his assistants, but the dislocation was successfully reduced. Incidentally, as a result of this experience, the patient became a teetotaler!

Henry Hill Hickman (1800–1830), an Englishman, in 1824 successfully anesthetized animals with carbon dioxide gas and published his results[8] which were not accepted and attracted little attention. It is quite apparent from the work of Hickman that he deliberately approached his experimental studies with a clear idea of the necessity and value of relieving the pain of operations. The unfortunate fact was that he had not selected the proper agent; and his failure to gain immediate recognition, at least for his ideas, was as tragic as was his very early death. Another premature advocate of painless surgery was Dr. John Elliotson (1791–1868) of London who, in 1843, advocated mesmerism and reported[9] that surgical operations could by its use be performed painlessly. Crawford W. Long (1815–1878) had in 1842 undoubtedly made successful use of ether for surgical operations but "through negligence," as he stated, delayed publication[10] of the fact until 1849. Had he not been goaded by his desire for recognition, it is certainly an open question as to how long the world might have waited for his report. The tragedy of Hickman's unsuccessful attempts to obtain recognition is repeated in the experience of Horace Wells (1815–1848) of Hartford, Connecticut. Wells fully realized the significance of, and the possibilities connected with, anesthesia and in 1844 used nitrous oxide in preference to ether, which he had also tried, for dental work and minor operations. However, his attempt to stage a successful public demonstration of nitrous oxide in Boston resulted in failure and ridicule. William T. G. Morton (1819–1868) spurred by the work of Wells, his former teacher and partner, requested aid from Dr. Charles T. Jackson (1805–1880) who was then his preceptor.[11] Jackson suggested the use of ether which Morton successfully employed at once for extraction of teeth and then on that historic day, October 16, 1846, for a surgical operation. Later Morton minimized the assistance of Jackson and bitterly turned against him. Having studied all of the historic documents of this

[8] H. H. Hickman, "A Letter on Suspended Animation etc.," in *Souvenir Henry Hill Hickman Centenary Exhibition* (London 1930) 30–35.

[9] J. Elliotson, *Numerous Cases of Surgical Operations without Pain in the Mesmeric State* (London 1843; also Philadelphia 1843).

[10] C. W. Long, "An Account of the First Use of Sulphuric Ether by Inhalation as an Anaesthetic in Surgical Operations," *South. Med. Surg. Jour.* n.s. 5 (1849) 705–713.

[11] *Annual Circular of the Massachusetts Medical College with a History of the Medical Department of Harvard University* (Boston 1846). Morton's name appears in the list of students, p. 29, and his instructer [*sic*] was Dr. C. T. Jackson.

controversy with care, I cannot feel any admiration for Jackson. Neither was Morton's attitude commendable, and that he could have forgotten the wording of the application[12] for a patent on October 27, 1846, which was signed jointly, seems unbelievable:

> To all persons whom these presents shall come: Be it known, that we, Charles T. Jackson and William T. G. Morton, of Boston, in the County of Suffolk and State of Massachusetts, have invented or discovered a new and successful improvement in surgical operations on animals, whereby we are enabled to accomplish many, if not all operations, such as are usually attended with more or less pain and suffering, without any or very little pain to, or muscular action of persons who undergo the same; and we do hereby declare that the following is a full and exact description of our said invention or discovery.

Regardless of the extent of Jackson's assistance, Morton, though an opportunist to say the least, deserves credit for having staged the first successful public demonstration of ether anesthesia. This resulted in the almost immediate adoption of the method throughout the world. Spectacular as was the demonstration of ether anesthesia by Morton, enough has been said to indicate that it was but the culmination of a long period of research and discovery.

The ether controversy has on several occasions entered into the adoption or continued use of school textbooks. The earliest episode in the State of Georgia of which I have information concerns the *History of Our Country for Higher Grades*, 1923, by Reuben Post Halleck (1859–1936). In 1923, as Professor Hallack informed me, he was chagrined because the book was rejected on account of his statement concerning anesthesia, which was as follows:

> *A conqueror of pain.*—It seems strange that a country recently expanded to the Pacific, busy with problems of immigration, settlement, transportation and inventions to increase material wealth, should have been the first to make a practical application of a discovery that opened the way for relieving the agony of human beings in every land. In honor of this important event, Boston has erected a monument with the following inscription:
>
> *To commemorate the discovery that the inhaling of ether produces insensibility to pain. First proved to the world at the Massachusetts General Hospital, in Boston, October, A.D., 1846.*

It is hard to realize that in all time before 1846 surgical operations had meant such torture that comparatively few had been performed. A man with the iron will of an Andrew Jackson might clutch a stick while the surgeon cut out of his shoulder a bullet which was giving him pain, but most of us would have let the

[12] S., "The Patent Letheon—Jackson and Morton's Specification," *Boston Med. Surg. Jour.* 36 (1847) 194–98.

bullet stay. The most important nineteenth-century discovery for the relief of suffering, and one of the most important in the history of the world, was the use of ether to produce insensibility to pain. This discovery enabled surgery to become one of the great arts of the world.

Opinions differ in regard to who first discovered this wonderful new use of ether. It is certain that Dr. W. T. G. Morton, a Boston dentist, made practical use of ether as an anaesthetic in both dentistry and surgery in the autumn of 1846. America has the honor of being the first to use ether for painless surgery. As soon as the news reached England, her surgeons made use of the new discovery. Americans may justly feel proud of the many ways in which their young nation helped the world.[13]

Immediately following the rejection of his book by the Georgia school authorities, Professor Halleck changed the last paragraph and included the names of Long, Wells, Jackson, and Morton. Because of the limited number of copies of the *History of Our Country* printed prior to the change, this first issue has become an extremely rare item.

As one delves into the books concerning anesthesia, a surprising number of errors will be observed. Some of these, particularly dates, may originally have been typographical and through copying by other writers have been perpetuated. My attention was first attracted to the error in the date of the first successful public demonstration of ether. Many authors,[14] in fact, almost half of those writing on anesthesia, give this date as October 17, 1846, instead of the correct one, October 16. Investigation indicates that the October 17 date is the result of the successive repetition of an error, originally typographical or otherwise, in a dissertation[15] by Dr. John C. Warren (1778–1856), the surgeon who performed the operation. Evidence of this is found in the following quotation:

> On October 17th, the patient being prepared for operation the apparatus was applied to his mouth by Dr. Morton. . . . On the following day, October 18th, an operation was done by Dr. Hayward, on a tumor of the arm, in a female patient at the Hospital. . . .

Nowhere else, either in his book[16] or other writings to which I have had access, does he mention a specific date. In his presidential address[17] before

[13] R. P. Halleck, *History of Our Country for Higher Grades* (New York 1923) 361–62.

[14] H. M. Lyman, *Artificial Anaesthesia and Anaesthetics* (New York 1881) 7; L. Turnbull, *Artificial Anaesthesia* (4th ed., Philadelphia 1896) 32; T. D. Luke, *A Guide to Anaesthetics for the Student and General Practitioner* (2nd ed., Edinburgh and London 1905) 6; F. W. Hewitt, *Anaesthetics and their Administration* (London 1922) 7.

[15] J. C. Warren, "Inhalation of Etherial Vapor for the Prevention of Pain in Surgical Operations," *Bost. Med. Surg. Jour.* 35 (1846) 375–79.

[16] J. C. Warren, *Etherization with Surgical Remarks* (Boston 1848) 4.

[17] J. C. Warren, *Address before the American Medical Association at the Anniversary Meeting in Cincinnati, May 8, 1850* (Boston 1850) 51.

the American Medical Association at Cincinnati in 1850, there is merely the following statement:

> The first surgical operation in which ether was used for the prevention of pain was performed by me in the Massachusetts General Hospital in the month of October, 1846. . . .

Dr. Walter Channing (1786–1876), a Bostonian and a member of the same faculty as Warren, in his *Treatise on Etherization in Childbirth*, states that the first operation performed under ether was on the 13th of October, 1846;[18] while Dr. Louis Figuier states the date to have been October 14, 1846;[19] and Dr. F. L. Dumont makes it the 7th of November, 1846.[20]

Willard and Adler in an historical introduction to their book *Artificial Anaesthesia and Anaesthetics* state that "the term *anaesthesia* was introduced into medical nomenclature in 1847, by the late Sir James Y. Simpson."[21] At times the names of the participants in the ether controversy are jumbled, especially by the foreign authors. Also the writers' knowledge of places is sometimes faulty, as shown by the statement of one that Wells was a native of Hartford, *Vermont*, and by two others that Long was a resident of Athens, *Greece*! These few errors, selected from many of the history of anesthesia which have come to my attention, would indicate the importance of consulting original sources and of checking even these.

To conclude, the following coincidence in the history of anesthesia seems worth mentioning. In 1872, Dr. J. Morgan of Dublin, Ireland, in a monograph[22] stressed the inherent dangers of chloroform and advocated the use of ether exclusively. In his book is described an ether inhaler (Fig. 1), consisting of an oval metal container having a rubber diaphragm inlet and a flexible rubber tube to which the facepiece was attached. In 1915 Dr. Ben Morgan of Chicago presented a paper[23] on anesthesia before the Mississippi Valley Medical Asoociation and exhibited a *new* ether apparatus. Later, in Louisville, he demonstrated his patented apparatus (Fig. 2), at which time I showed him a copy of the Dublin Morgan's book and inquired whether he were a relative. He denied ever having seen the book or even having heard of the other man. Thus in the history of anesthesia, there is apparently the remarkable coincidence of two unrelated Morgan inhalers, which are strikingly similar in outward appearances.

[18] W. Channing, *A Treatise on Etherization in Childbirth* (Boston 1848) 26.

[19] L. Figuier, *Exposition et Histoire des Principales Découvertes Scientifiques Modernes* (Paris 1851) 1. 227.

[20] F. L. Dumont, *Handbuch der allgemeinen und lokalen Anaesthesie* (Berlin 1903) 20.

[21] DeForest Willard and L. H. Adler, *Artificial Anaesthesia and Anaesthetics* (Detroit 1891) 1.

[22] J. Morgan, *The Dangers of Chloroform and the Safety and Efficiency of Ether . . . with a Description of an Ether Inhaler* (London 1872).

[23] B. Morgan, "Practical Anesthesia, Showing a New Ether Apparatus," *Lancet-Clinic* 95 (Cincinnati 1916) 230–31.

Mesmerism and Surgery

A STRANGE CHAPTER IN THE HISTORY OF ANESTHESIA

GEORGE ROSEN*

IN 1853 the Congress of the United States offered the sum of $100,000 to the person who should be adjudged the true discoverer of the anesthetic property of ether, which was described as the earliest anesthetic. On August 8, 1853, James Esdaile, M.D. of Perth, Scotland, addressed to Congress a Memorial[1] in which he indignantly denied that painless surgery had first become possible as a result of the discovery of ether anesthesia, drawing attention to "the simple and notorious fact . . . that painless surgery by means of mesmerism, years before ether was heard of, was as common in my hospitals, as it has since become in Europe under the influence of chloroform, and nearly three hundred capital mesmeric operations had been performed by me before leaving India, two years ago."[2]

Behind this Memorial lies a fascinating but neglected chapter in the medical history of the nineteenth century; the story of *the use of mesmerism for surgical anesthesia*. Mesmerism in surgery is an integral aspect of the mesmeric movement that began in England in 1837 under the leadership of John Elliotson. Thirty-odd years later, in 1874, J. F. Clarke, who had witnessed the origin of this movement, described it tersely as "a strange chapter in the history of medicine."[3]

The first events of the story occurred in 1829. In that year an Irishman named Chenevix who had been living in Paris and practicing mesmerism there, paid a short visit to London.[4] During this visit Chenevix gave several demonstrations of mesmeric phenomena. Arrangements were made by Elliotson for Chenevix to try mesmerism on certain patients at St. Thomas's Hospital. Elliotson was not completely won over to mesmerism

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[1] "The Protest and Petition of James Esdaile, M.D., Surgeon H.E.I.C.S., to the Members of the American Congress," *Zoist* 11 (1853–54) 294–97.

[2] *Ibid.* 296.

[3] J. F. Clarke, *Autobiographical Recollections of the Medical Profession* (London 1874) 155: "There is no chapter in the history of Medicine more astounding and bewildering than the episode of 1837–38, when for a time animal magnetism or mesmerism engrossed the attention of the Profession and the public. It was not a mere popular mania, . . . on the contrary it engaged the minds of some of the greatest physiologists of the time, and its 'manifestations' were witnessed by philosophers, poets, literary men, and amateurs."

[4] There is a statement in one source that Chenevix came to London in 1828 (*Zoist* 1 [1843–44] 61), while another source gives 1829 as the date of the visit (*Lancet* 2 [1836–37] 871).

at this time, but he felt that it was a subject deserving of further investigation. An account of these experiments was published in the *London Medical and Physical Journal* for 1829.[5] Chenevix died in 1830, and Elliotson apparently had neither opportunity nor time to continue the experiments, although he maintained an interest in mesmerism.

In 1837, an opportunity for the resumption of mesmeric investigations presented itself. Early that year a Frenchman named Dupotet,[6] who had long practiced mesmerism in France, came to London to propagate the doctrine of animal magnetism. He was reputed to be able to cure epilepsy and related disorders by means of mesmerism. Dupotet had an introduction to the Middlesex Hospital and was permitted to experiment on several patients, but the attending physicians and surgeons paid no attention to his efforts. This indifference soon led Dupotet to seek more congenial company, and before long he became associated with Elliotson at the North London (or University College) Hospital.[7]

It was here that the events took place which brought professional ostracism and notoriety upon Elliotson, and at the same time made him the leader of the mesmeric movement in Britain. But before moving on to these developments, let us look briefly at the earlier history of John Elliotson.[8]

Elliotson, the son of a Southwark druggist who had amassed a considerable fortune, was born on October 29, 1791. Privately educated, he received a sound classical training. His medical studies were begun at Edinburgh, and later completed at Cambridge. In 1817, he was appointed assistant physician to St. Thomas's Hospital, and physician six years later. At the time of his appointment, Guy's and St. Thomas's had their medical school

[5] "Abstract of a clinical Lecture by Dr. Elliotson on Remarkable Cases of Sleep Waking; and the effects of Animal Magnetism on Patients with Nervous Affections," *Lancet* 2 (1836–37) 871–72; "Mesmerism," *Zoist* 1 (1843–44) 61, 88.

[6] It is interesting to note that a "magnetic séance" conducted by Dupotet in 1849 is described by Elizabeth Blackwell in her autobiography, *Pioneer Work for Women* (Everyman's Library Edition, London and New York, 1914) 122–24.

[7] The manner in which Elliotson and Dupotet became associated is not clearly indicated in the available sources. The earliest statement on this point (*Lancet* 2 [1836–37] 872) says Elliotson "heard of Baron Dupotet being in London, who had magnetised for twenty years and some of whose works on magnetism he (Dr. E.) had read. He was determined to ask him to afford his assistance. . . ." According to the later account in the *Zoist* 1 [1843–44] 89) Dupotet was advised "to go to Dr. Elliotson, who . . . would look into the subject (mesmerism) and soon see if there was anything in it. M. Dupotet followed this advice, was well received by Dr. Elliotson. . . ." Clarke writing in 1873 simply says (p. 160): "Early in the year 1837, a Frenchman, by name Baron Dupotet, obtained an introduction to him [Elliotson]."

[8] For biographical data see: J. F. Clarke, *op. cit.* (see note 3) 179–81; Robert Hunt, "John Elliotson," *D.N.B.* 18 (1886); T.R.E., "John Elliotson, M.D. Camb., F.R.S.," *University College Hospital Magazine* 1 (1910–11) 272–84; George Rosen, "John Elliotson, Physician and Hypnotist," *Bull. Inst. Hist. Med.* 4 (1936) 600–603; J. Milne Bramwell, *Hypnotism. Its History, Practice and Theory* (3d ed. London, William Rider and Son, Ltd. 1921,) 4–5.

in common; the men from Guy's who were in a majority on the staff made it very difficult for the Thomas's men to lecture. Elliotson objected strongly to this situation and in 1825, when the schools were separated, he received the privilege of giving clinical lectures.

In 1827–28, he began to publish in the *Lancet* clinical reports of cases that he had under treatment at the hospital. These were almost immediately successful, and won for him reputation and practice. In 1831, Elliotson was appointed the first Professor of the Practice of Medicine at the new University of London. Here he urged that a hospital be established in connection with the University. No doubt his popularity and success as a teacher added force to his arguments, and helped to bring about the opening of the North London or University College Hospital in 1834. To this institution Elliotson was appointed Senior Physician, and he immediately resigned his position at St. Thomas's.

By 1837 Elliotson had established his position and secured a reputation as one of the ablest physicians of London. His active and inquisitive mind was continually exercised on new ideas and phenomena. At the University College Hospital he carried out various therapeutic experiments, administering to patients large doses of drugs usually regarded as dangerous. His progressive attitude in medicine is clearly revealed in his passionate advocacy of the stethoscope, which was then still a new instrument and regarded suspiciously. It was because of these activities that Elliotson was known among his colleagues as an "experimenter";[9] and an attempt was even made in a court of law to invalidate his testimony because he used the stethoscope.[10]

Elliotson was deeply interested in physiology,[11] particularly in the physiology of the nervous system. As a result be became a student of phrenology,[12] and helped found the Phrenological Society of London. At the same time, he was also profoundly interested in advancing therapeutics. It is reported that he used to say: "We know quite enough of physiology and pathology, but we are profoundly ignorant of curative treatment."[13] Furthermore, Elliotson was a man of strong character and

[9] "Dr. Elliotson on Clinical Instruction, and its Improvements; the Employment of New Remedies; Good and Bad Experiments, and Animal Magnetism," *Lancet* 1 (1837–38) 122.

[10] "Remarks on Dr. Fraser's inconsistency. Note by Dr. Elliotson," *Zoist* 10 (1852–53) 73.

[11] Elliotson translated Blumenbach's *Physiology*, to which he appended numerous notes. An edition was published in this country (J. F. Blumenbach, *Institutions of Physiology*. Translated from the Latin of the third and last edition with notes by John Elliotson, 2nd ed., Philadelphia 1817). Later it was reissued as *Human Physiology*, the 5th edition appearing in 1840.

[12] J. Elliotson, "On the Ignorance of the Discoveries of Gall evinced by recent physiological writers," *Lancet* 1 (1837–38) 295–98.

[13] Clarke, *op. cit.* (see note 3) 160–61.

firm convictions. When once he was convinced of something and his mind made up, he felt it his duty to stand firm and to suffer the consequences, whatever they might be. It is necessary to keep in mind Elliotson's interests and temperament in order to understand how he became involved with mesmerism in 1837.

On April 4, 1837, a girl of eighteen, named Elizabeth O'Key,[14] was admitted to the North London Hospital. She was a housemaid who suffered from hystero-epileptic attacks. At first she was treated in the customary manner with copious venesection and "calomel, grains V, night and morning until the mouth became sore, and then only one ounce of magnesium sulphate daily."[15] Apparently the treatment was without success, for soon after Dupotet became associated with Elliotson, they began to treat Elizabeth O'Key with mesmerism. At the same time Elliotson together with his clinical clerk, W. Wood, regularly mesmerized other patients, among them Jane O'Key, the sister of Elizabeth.

These investigations attracted considerable attention, and at first Elliotson's lectures were reported objectively in the *Lancet*.[16] During the latter part of 1837, however, there occurred the first skirmish in the controversy over mesmerism, a controversy which within a year would be transformed into a bitter feud that would last for about two decades. This initial encounter took the form of an exchange of letters, from September to November, between Elliotson's assistant, Wood, and an anonymous "Eye Witness."[17]

At the same time it should be noted that there was considerable interest in mesmerism in other quarters. On February 14, 1838, a Dr. Sigmond became professor of materia medica at the Medico-Botanical Society of London; on this occasion he delivered an address in which he dealt with mesmerism, giving a history of the subject.[18] In this lecture he reported

[14] The name is spelled differently in various accounts. Elliotson spelled the name Okey; Wakley used O'Key, and Clarke also used this spelling. An anonymous writer in *Chambers Edinburgh Journal* (October 26, 1839) used the form Okey. It seems probable that the form O'Key is the correct one.

[15] T.R.E., "John Elliotson, M.D. Camb., F.R.S.," *University College Hospital Magazine* 1 (1910–11) 278.

[16] "Abstracts of a Clinical Lecture by Dr. Elliotson, on Remarkable Cases of Sleep Waking; and the Effects of Animal Magnetism on Patients with Nervous Affections," *Lancet* 2 (1836–37) 866–73; "Dr. Elliotson on Clinical Instruction and Its Improvements; the Employment of New Remedies, Good and Bad Experiments, and Animal Magnetism," *Lancet* 1 (1837–38), 122–24.

[17] "The Trials of Animal Magnetism at University College Hospital, by An Eye-Witness," (Sept. 25, 1837), *Lancet* 1 (1837–38) 99–101; "Mesmerism in London. Reply to the Letter of an Eye Witness, by W. Wood, Clinical Clerk," (University College Hospital, October 17, 1837), *ibid.* 1. 163–65; "Mesmerism at University College Hospital. The Eye Witness," (October 30, 1837), *ibid.* 1. 210–11; "Mr. Wood on Mesmerism at the University College Hospital," (November 6, 1837), *ibid.* 1. 277–78.

[18] "Address delivered before the Medico-

that on April 12, 1829, Jules Cloquet had removed a breast while the patient was in mesmeric sleep.[19] The *Lancet* also carried letters from physicians, reporting cases treated by animal magnetism.[20]

Meanwhile, Elliotson was actively pursuing his researches. At first his studies had been carried on in the wards, but the number of those who came to observe grew so large that he was obliged to mesmerize in the theatre of the hospital. Among the clinical notes on the case of Elizabeth O'Key there is an interesting entry, that Messrs. Charles Dickens and Cruikshank were present at a demonstration in the ward.[21]

The mesmeric demonstrations at the North London Hospital were soon the talk of London, and the public flocked to see them.[22] On Thursday, May 10, 1838, more than two hundred persons, both medical and lay, attended, among them the Marquis of Anglesea, the Duke of Roxburgh, and the Earl of Burlington. On June 2, there was another long séance, lasting three hours. Among those present on this occasion was Thomas Moore, the poet. These demonstrations were reported in the *Lancet* in a series of eight reports.[23]

In the meantime, opposition to Elliotson's demonstrations had been developing within the Hospital. Here the factor of intramural politics appears in the story. Clarke relates:

> At this time there were two parties in the medical staff of the University. One might be said to be headed by Elliotson, the other by Liston. A strong personal dislike had long existed between these two remarkable men, and each of them lost no opportunity of annoying the other. The scenes in the Medical Committee room of the Hospital were often of a very exciting character. Remarks of a very offensive kind were frequently made . . . .[24]

Liston's party had been in the minority, but in Elliotson's experiments with mesmerism they found the chink in his armor.[25] Early in June, the Medical Committee of the Hospital met to consider published statements concerning animal magnetism that had appeared in the *Lancet*. Elliotson

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Botanical Society of London, Wednesday, February 14th, 1838, by Dr. Sigmond, On the occasion of his taking the chair of Professor of Materia Medica to that Institution," *Lancet* 1 (1837–38) 769–76.

[19] *Lancet* 1 (1837–38) 775.

[20] *Lancet* 2 (1837–38) 81–83, 168–69, 458–59.

[21] *University College Hospital Magazine* 1 (1910–11) 278.

[22] "Mesmerism," *Zoist* 1 (1843–44) 91.

[23] "Experiments with Animal Magnetism at University Hospital," *Lancet* 2 (1837–38) 282–88; "Animal Magnetism. Second Report of Facts and Experiments," *ibid.* 2. 377–83; "Animal Magnetism. Conclusion of Second Report," *ibid.* 2. 400–403; "Animal Magnetism. Third report of Facts and Experiments," *ibid.* 2. 444–46; Fourth Report, *ibid.* 2. 546–49; Sixth Report, *ibid.* 2. 585–90; Seventh Report, *ibid.* 2. 615–20.

[24] Clarke, *op. cit.* (see note 3) 176.

[25] Robert Liston (1794–1847) performed the first operation under ether in Britain at the University College Hospital on December 21, 1846.

did not attend, but resolutions were passed requesting him to refrain from further "public exhibitions" of mesmerism, yet stating that there was no desire to interfere with its employment as a remedial agent.

The interest aroused by Elliotson's activities led Thomas Wakley, the crusading editor of the *Lancet*, to undertake a test of his claims. Elliotson believed that animal magnetism[26] was a distinct physical force which could be imparted to non-magnetized bodies, either by a magnetizer or by transfer from magnetized bodies. In addition, he believed that mesmerized individuals possessed clairvoyant powers. Elliotson also had the firm belief that metallic nickel possessed unusual powers of inducing the mesmeric state.

On August 16, 1838, Wakley put these claims to a critical test at his house in Bedford Square.[27] Wakley had invited Dr. William Farr, Mr. Hale Thomson, and Dr. Hennis Green to witness the experiments; Baron Dupotet, Dr. Richardson, Mr. Herring, and Mr. J. F. Clarke were invited by Elliotson. With the help of Clarke, Wakley substituted "non-magnetized" lead for the nickel and showed that the same effects could be produced with the lead. All that this proved was that nickel did not exert the specific influence attributed to it by Elliotson, but for Wakley it was enough to discredit the phenomena manifested by the O'Key sisters.[28]

This "exposure" of Elliotson's claims immediately brought forth an editorial blast by Wakley in the *Lancet* in which he condemned mesmerism.[29] On Saturday, Sept. 15, Wakley again loosed an editorial broadside.[30] "The 'science' of mesmerising," he wrote, "like the 'science' of fortune telling, will always carry on a precarious existence wherever there are clever girls, philosophic Bohemians, weak women, and weaker men, but it can no longer affront the common sense of the medical profession, or dare to show its face in the scientific societies after the late exposure . . . ." From this time on Wakley savagely castigated what he termed the "Mesmeric Humbug."

At the Hospital, Elliotson continued to lecture on mesmerism and to

[26] Or mesmerism. The terms are used interchangeably.

[27] " 'Animal Magnetism'; or 'Mesmerism.' Experiments performed on Elizabeth and Jane O'Key, at the House of Mr. Wakley, Bedford Square, in August 1838," *Lancet* 2 (1837–38) 805–11. See also Clarke, *op. cit.* (see note 3) 183–90; S. Squire Sprigge, *The Life and Times of Thomas Wakley* (London 1897) 444–49.

[28] Both Elliotson and Wakley were so imbued with the idea of materialism that neither one even attempted another explanation of mesmeric phenomena. For Elliotson, mesmerism could not be produced except by a "physical force," and in the eyes of Wakley the annihilation of Elliotson's theory was equivalent to a demonstration that mesmeric phenomena were faked.

[29] *Lancet* 2 (1837–38) 834–36.

[30] *Lancet* 2 (1837–38) 873–77.

demonstrate mesmeric phenomena, until December 27, 1838, when the Council of University College met and passed the following resolution: "That the Hospital Committee be instructed to take such steps as they shall deem most advisable to prevent the practice of mesmerism or animal magnetism in future within the hospital."[31] A copy of this resolution was then sent to Elliotson, who immediately resigned from his position in the College and the Hospital.[32]

He was now a man with a mission—to demonstrate the truth of mesmerism. And to this end he bent all his energies. The experiments and demonstrations with the O'Key sisters were continued at the home of Elliotson in Conduit Street. An account in *Chambers' Edinburgh Journal* for October 26, 1839 throws some light on this period.[33]

> One day lately while residing a short time in London, I dined at the house of a gentleman in the neighborhood of Portman Square, where I happened to meet and form the acquaintance of the celebrated Dr. Elliotson. I had heard of this gentleman only by vague report, and knew nothing further regarding him than that he had been zealous in the pursuit and practice of animal magnetism, for which he had incurred not a little obloquy and professional animosity. . . . On my bringing the conversation round to the subject with which his name was so intimately connected, I found that he had formed no distinct code of laws or precise theory regarding mesmerism, as he called it. He said that the experiments he had been able to make, were in his opinion, highly interesting, as developing physical and mental phenomena of no ordinary kind; that he felt assured that there existed in nature an unseen agent or agency, an influence, or whatever it might be called, which flowed from one living animal to another like a stream of electricity, although, at the time the animals were not in contact with each other; and that in highly irritable conditions of the bodily frame, that agency produces certain phenomena of a most remarkable kind; that he did not pretend to account for or to understand the nature of the agency; all he insisted upon was, that such an agency existed, that it could be excited into activity, and was therefore, as a truth in nature, worthy of being examined, and to have its phenomena duly recorded. "I do not wish to lead you one way or another," he continued; "but if you feel any inclination to pursue the inquiry, call at my house, and I will perform some experiments in your presence, on two patients, and you can think for yourself."
>
> These explanations were so candid and fair that I at once agreed to go and see the experiments. Tuesday next at four o'clock was appointed for my visit; and at that time I proceeded to the doctor's house, an elegant mansion in Conduit

[31] Clarke, *op. cit.* (see note 3) 176.

[32] The high regard in which the students held Elliotson is shown by the fact that on January 5, 1839 they held a mass meeting in the Anatomical Theatre of University College, and by a vote of 124 to 113 passed a resolution regretting his resignation. Clarke, *op. cit.* 178–79.

[33] "Visits to Dr. Elliotson's," *Chambers' Edinburgh Journal* (Saturday, October 26, 1838), 337–38.

Street, taking with me two gentlemen of my acquaintance, one of them a medical man, who had never seen any experiments in mesmerism, and who I hoped would have all his eyes about him to make sure that there was no trickery or collusion.

We were shown into a splendid suite of rooms; and the doctor, his assistant, and his two patients, immediately made their appearance. The two patients, as he mentioned to me, were sisters, Elizabeth and Jane O'Key, the former eighteen, and the latter sixteen years of age.[34]

The writer goes on to describe the various experiments to demonstrate the hypnotic state. On the following day this observer returned for further demonstrations. This time there was a public exhibition at which thirty or forty men and women were present. Indeed, Elliotson continued to hold séances at his home and they were very well attended.[35]

In order to present his own cause favorably and to build up in the minds of his followers an appropriate image of the opposition, a cult leader, such as Elliotson now became, requires a medium of expression, a forum for the presentation of his views. Elliotson obtained this in 1843 when he and his sympathizers started a journal entitled *The Zoist: A Journal of Cerebral Physiology and Mesmerism, and their Applications to Human Welfare.* This journal appeared quarterly from April 1843 to December 1855, for complete thirteen volumes. The essential character of the *Zoist* is indicated in the title, and is explicitly emphasized in the prospectus with which the first number opens.

The object of this work is to collect and diffuse information connected with two sciences—Cerebral Physiology[36] and Mesmerism.... A periodical devoted to these objects has long been a desideratum and the Editors of this Journal will endeavor to furnish a medium for the freest expression of thought on questions of social, moral, and intellectual progress.... They aim to be truth seekers, and they consider it to be their duty, to promulgate the "truth of facts" impelled by the conviction that all truths are subservient to the happiness of mankind.

The discovery of a new truth gives to the philosopher intense delight. The science of MESMERISM is a new physiological truth of *incalculable* value and importance; and, though sneered at by the pseudo-philosophers of the day, there is not the less certainty that it presents the only avenue through which is discernible a way of hope that the more intricate phenomena of the nervous system—of Life,—will ever be revealed to man. Already has it established its claim to be considered a most potent remedy in the cure of disease; already enabled the knife of the operator to traverse and divide the living fibre unfelt by the patient. If such are the results of its infancy, what may not its maturity bring forth?[37]

[34] *Ibid.* 337.

[35] "Remarks upon an anonymous account in Blackwoods Magazine of a visit to Dr. Elliotson's house, permitted six years ago to a stranger. By Dr. Elliotson," *Zoist* 9 (1851–52) 284–98.

[36] Cerebral physiology = Phrenology.

[37] *Zoist* 1 (1843–44) 1–2.

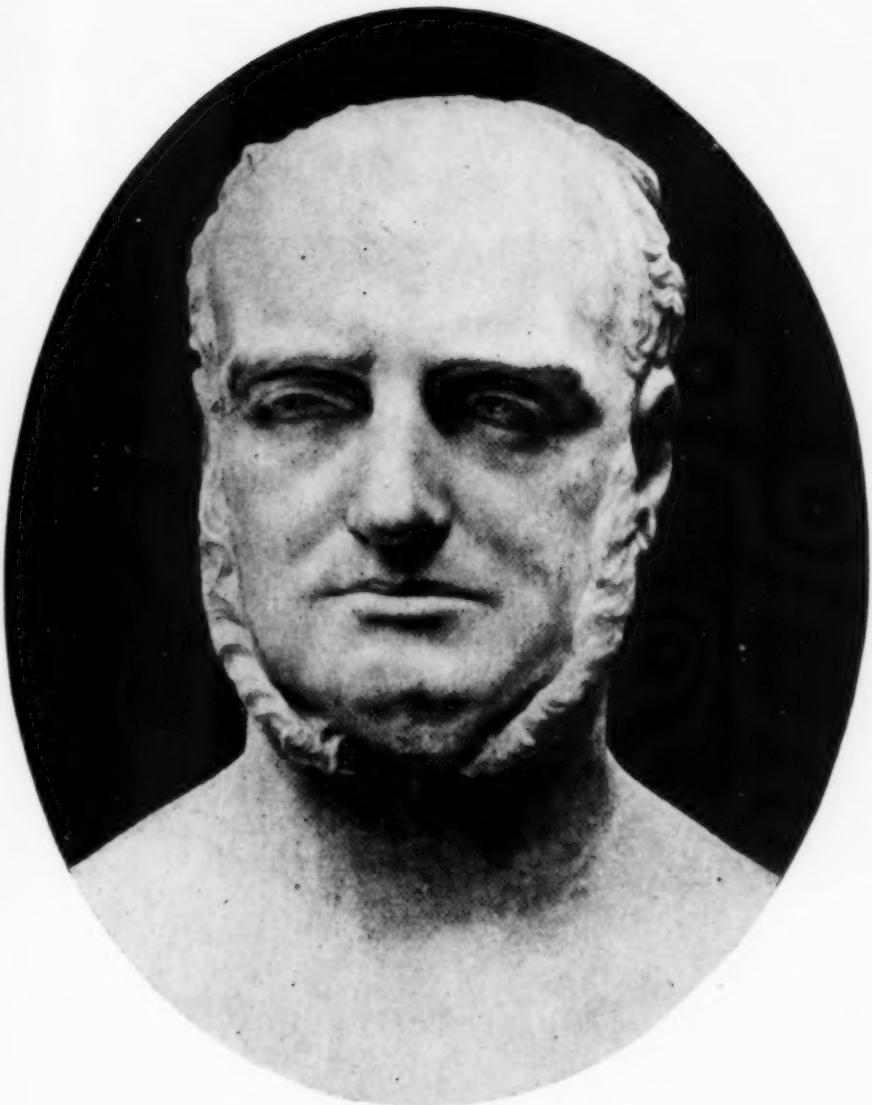

FIG. 1. Dr. John Elliotson, F. R. S.
(From a bust in the possession of the Royal Society of Medicine.)

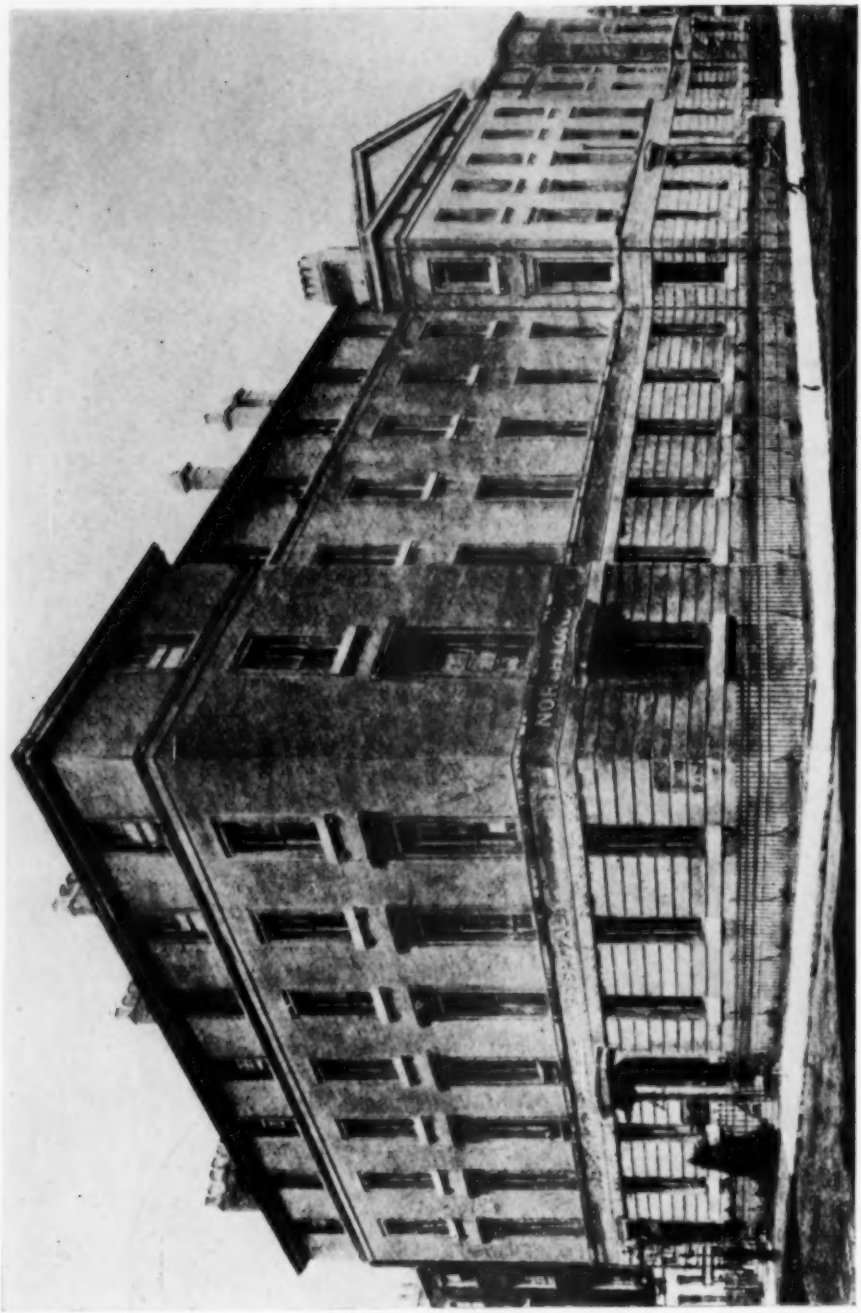

FIG. 2. The Old University College Hospital.

In accordance with its avowed purpose, the *Zoist* presented articles on phrenology and mesmerism. Many papers were contributed by Elliotson who was a constant writer in the journal. The purpose of these communications was essentially propagandistic. For the most part they comprised reports on patients treated with mesmerism, testimonials and endorsements from physicians and satisfied patients, and polemics with opponents of mesmerism. In addition, the *Zoist* also concerned itself with social problems, such as housing, crime, and education. The views expressed on these questions were based generally on phrenological theory; and it is worthy of note that these views were very progressive. Thus, opposition to capital punishment was forcibly expressed on several occasions, and demands were raised for the mental examination of criminals.[38] (This point is suggestive and might be made the starting point of a study of phrenological views on mental diseases and criminal law.)[39] An article bearing the title "Physical Well-being, a necessary preliminary to Moral and Intellectual Progression" emphatically drew attention to the evils arising from lack of sanitation and overcrowding in the homes of the working masses.[40] The ill effects of poor housing in terms of premature mortality were pointed out and a demand made for better housing. In the field of education, the *Zoist* insisted on the need for a national educational system: "Education is the proper remedy for crime, and there ought to be a national system of education, apart from religious belief and sectarian influence."[41]

Among the contributors to the *Zoist* were a number of well-known persons. The first two volumes contain several phrenological articles by Herbert Spencer: "A new view of the Functions of Imitation and Benevolence," "On the Situation of the Organ of Amativeness," and "A Theory concerning the Organ of Wonder."[42] Harriet Martineau cured a cow with mesmerism, and reported this interesting fact to Elliotson.[43] Volume 10 of the *Zoist* for 1852–53 contains a contribution from Richard F. Burton, the

[38] "Our Criminal Code," *Zoist* 1 (1843–44) 101–110; "Capital Punishment; or, Killing according to Law," *ibid.* 7 (1849–50) 331–53; "1. Reviews of Remarks on the Plea of Insanity, and on the management of Criminal Lunatics. By Wm. Wood, M.D. 2. Crime and Insanity, their causes, connexion, and consequences, &c. By C. M. Burnett, M.D.," *ibid.* 10 (1852–53) 103–15; "A Visit to the Great Prison in Munich. By the Rev. Chauncey Hare Townshend, A. M. Cantab. In a letter to Dr. Elliotson," *ibid.* 13 (1855–56) 419–40.

[39] See, e.g., *Zoist* 1 (1843–44) 253–62.

[40] *Zoist* 5 (1847–48) 82–101.

[41] "Education as it is, and as it ought to be," *Zoist* 2 (1844–45) 1–20.

[42] *Zoist* 1 (1843–44) 369–85; 2 (1844–45) 186–88; 316–25.

[43] "Mesmeric Cure of a Cow, by Miss Harriet Martineau. By Dr. Elliotson," *Zoist* 8 (1850–51) 300–303; "Distressing effects produced in a Doctor upon the removal of a Disease from a Cow with Mesmerism. By Miss Harriet Martineau. Communicated by Dr. Elliotson," *Zoist* 8 (1850–51) 333–37.

famous explorer, orientalist, and translator of the *Thousand and One Nights*, on Mesmerism in the Orient.[44]

Various curious items are scattered throughout the pages of the *Zoist*. The utilization of phrenology in choosing members of parliament is proposed in 1846;[45] six years later occurs a report of "Mesmeric Baptism," where a mesmerizer prevailed upon the parents of a baby to have it christened Mesmer.[46] In the same issue the reader is instructed on the "choice of a mesmeriser."[47] Even poetry on mesmeric subjects is to be found in the *Zoist*.[48]

Aside from these extravagances, however, which are often found on the "lunatic fringe" of a cult or sect, numerous medical and surgical cases observed by Elliotson and others were reported in the journal. It is the surgical cases in which we are interested here, for *these operations had been performed painlessly during mesmeric trance.*

The use of mesmerism for surgical anesthesia did not originate with Elliotson. On April 12, 1829, Jules Cloquet,[49] a French surgeon, had performed a mastectomy on a patient in mesmeric sleep.[50] According to Elliotson the first surgical procedure performed under mesmerism in England was the insertion of a seton in the neck of Elizabeth O'Key in 1838. Four years later, a surgeon named Ward performed the first major operation in England on a patient in a mesmeric state; in 1842, in Nottinghamshire, he amputated a leg at the thigh.[51] Before the operation Ward consulted Elliotson. "It is a great happiness to me," wrote Elliotson, "that, before Mr. Ward undertook to operate as he did in the case which has been described, I was originally consulted upon the possibility and safety of operating in the mesmeric state without pain and gave a decided opinion that to induce such a state and perform the most painful operation in it, both without pain and with a successful result was very practicable. I had myself witnessed five years previously the introduction of a seton into the

[44] "Remarks upon a form of Sub-mesmerism, popularly called Electro-Biology, now practised in Scinde and other Eastern Countries. By Richard F. Burton, Lieut. Bombay Army. Communicated by Dr. Elliotson," *Zoist* 10 (1852–53) 177–81.

[45] "On the Application of Phrenology in the Choice of Parliamentary Representatives," *Zoist* 3 (1845–46) 399–416.

[46] "Mesmeric Baptism," *Zoist* 10 (1852–53) 227.

[47] "Choice of a Mesmeriser," *Zoist* 10 (1852–53) 227.

[48] Anna Savage, "The Magnetic Sleeper," *Zoist* 3 (1845–46) 120; Mrs. Abdy, "The Mesmerist," *Zoist* 10 (1852–53) 377–78.

[49] For Cloquet, see I. de Fourmestraux, *Histoire de la Chirurgie Française (1790–1920)* (Paris, Masson et Cie., 1934) 64–65.

[50] *Lancet* 1 (1837–38) 775.

[51] For a full account of this case see John Elliotson, *Numerous Cases of Surgical Operations Without Pain in the Mesmeric State; with Remarks upon the Opposition of many Members of the Royal Medical and Chirurgical Society and Others to the Reception of the Inestimable Blessings of Mesmerism* (London 1843) Chapter I.

back of the neck of Elizabeth O'Key without sensation in the mesmeric state."[52] This case was reported to the Royal Medical and Chirurgical Society, but the report was received with incredulous hostility. It was asserted that the patient was an impostor who had been trained not to show pain. Marshall Hall claimed that if the man were not an impostor, he would have manifested reflex movements in the other leg; and a Dr. Copland even proposed that no entry be made in the minutes of the Society of the paper having been read.

This hostile reaction aroused Elliotson to defend his associate, and in 1843 he published a pamphlet entitled *Numerous Cases of Surgical Operations Without Pain in the Mesmeric State* . . . , in which he gave a full account of Ward's case, and added to it an account of Cloquet's case as well as of numerous dental extractions. The same year saw the appearance of the first issue of the *Zoist*, and in it Elliotson continued his polemic with the Anti-mesmerists.[53] This battle of words runs like a red thread through the thirteen volumes of the *Zoist* and is reflected in the *Lancet*, the *British and Foreign Medical Review*, the *Medico-Chirurgical Review*, and other medical journals that opposed mesmerism. At the same time Elliotson continued to collect reports of surgical cases in which mesmerism had been employed. Another group appeared in the second volume of the *Zoist*.[54] In this collection are reports of venesection, dental extraction, the establishment of setons and issues, excision of tumors, amputations, and the use of mesmerism in a case of labor. It is interesting to note that Elliotson reports a "Case of Excision of a Wen, without pain, in the Mesmeric State," taken from the *Illinois Telegraph and Review*, August 19, 1843, and the removal of a tumor from the shoulder, taken from the *Missouri Republican*, February 21, 1843.

The third volume of the *Zoist* (March 1845 to January 1846) presented three further reports on surgical operations performed on patients under mesmeric anesthesia.[55] Among these cases are four from America: 1. the "Removal of a Tumor from the Neck in the Mesmeric State—performed in New York—reported by A. Sidney Doane, M.D. Witnessed among others by Drs. Valentine Mott, J. Kearney Rodgers, Delafield, John W. Francis"; 2. "Removal of another Tumor from the neck of an elderly

[52] *Ibid.* 65.

[53] "Antimesmeric Falsehoods of Medical Men," *Zoist* 1 (1843–44) 208–10.

[54] Elliotson, "A Collection of more instances of Surgical Operations rendered painless by means of mesmerism," *Zoist* 2 (1844–45) 90–123.

[55] "More Surgical Operations without Pain," *Zoist* 3 (1845–46) 206–16; "Surgical Operations without Pain in the Mesmeric State," *ibid.* 3 (1845–46) 380–89; Elliotson, "More painless Amputations and other Surgical Operations in the Mesmeric State," *ibid.* 3 (1845–46) 490–508.

Medical Man Related in the Cleveland Plain Dealer, Performed at Cleveland Medical College by Professor Ackley, assisted by Professors Delamater, Kirkland, and others"; 3. "the removal of a polyp from the nose (sent to the *Boston Medical and Surgical Journal*)"; and 4. the removal of a breast by Dr. L. A. Dugas, professor of physiology in the Medical College of Georgia.

These American reports are of particular interest for several reasons. In the first place, it is apparently to these accounts that Crawford Long referred in his paper read in 1848.

> At the time I was experimenting with ether there were physicians high in authority, and of justly distinguished character who were the advocates of mesmerism, and recommended the induction of the *mesmeric state* as adequate to prevent pain in surgical operations. Notwithstanding thus sanctioned I was an unbeliever in the science, and of the opinion that if the mesmeric state could be produced at all it was only on those with strong imaginations and weak minds, and was to be ascribed solely to the workings of the patients' imagination. Entertaining this opinion, I was the more particular in my experiments in etherization.[56]

Secondly, it would seem that in the United States the opposition of the medical profession was not as violent as in England. Some of the leading medical men in this country were willing at least to study and to observe the phenomena of mesmerism. Knowledge of mesmerism was apparently widespread in the United States at this time. Thus, in a letter to her mother, dated July 27, 1845, Elizabeth Blackwell relates: "I have just performed my first professional cure, and am already dubbed Dr. Blackwell by the household. I mesmerised away a severe headache that afflicted Miss O'Heara. . . ."[57]

Opposition there was, but it was not as vituperative as that of the British medical journals. Dr. Louis A. Dugas, for example, performed the operation mentioned above on January 12, 1845, and reported the case on February 1, 1845. The report was published in the *Southern Medical and Surgical Journal* which was edited by Paul F. Eve, professor of surgery at the Medical College of Georgia and an opponent of mesmerism.[58] At the request of the medical students, whose interest had been aroused by

[56] C. W. Long, "An account of the first use of sulphuric ether by inhalation as an anaesthetic in surgical operations," *South. Med. and Surg. Jour.* 5 n.s. (1849) 705–13.

[57] Blackwell, *op. cit.* (see note 6) 33. In this connection, one may suggest that an intensive study of mesmerism in the United States during the nineteenth century would undoubtedly reveal information of considerable interest. Attention may also be called to Henry James's *Bostonians*, where in the persons of Verena Tarrant and her father, we have a late echo of mesmerism in America.

[58] L. A. Dugas, "Extirpation of the Mamma of a female in the Mesmeric Sleep, without any evidence of sensibility during the Operation," *South. Med. and Surg. Jour.* 1 (n.s. 1845) 122–25.

Dugas's report, Eve delivered a lecture on mesmerism on February 18, 1845:[59]

> In the course of lectures on Surgery which it has been my duty to deliver before you this winter, and which is now drawing to a close, I took occasion to allude to it [mesmerism], incidently, once or twice. When recommending the means employed to relieve or prevent pain during the performance of surgical operations, you will recollect this supposed agent was not included among them. An operation having been performed by one of the professors of this college upon a patient in the "mesmeric state," without evincing consciousness or pain, it was natural for you to desire to know why I had excluded it from the therapeutical applications in Surgery.

Eve based his rejection of mesmerism on the ground that it "is not a reality; but that the phenomena ascribed to it, are firstly due to the imagination and excited feelings." Furthermore, "non-expression of pain is no proof of its non-existence."

To this Dugas replied with an ardent defense of mesmerism and Elliotson; and in July 1845 reported a second mesmeric operation on the same patient for a recidivation of the tumor.[60] Curiously enough, the motto on the title page of the *Southern Medical and Surgical Journal* is "Je prends le bien où je le trouve," but apparently Eve felt that this did not apply to mesmerism.

The same issue of the *Zoist* in which Elliotson reported Dugas's case, also contains the first report on the work of Esdaile, whose remarkable series of mesmeric operations, performed in India from 1845 to 1851, provided the most significant accomplishment in the application of mesmerism for surgical anesthesia.

James Esdaile, son of the Rev. Dr. Esdaile of Perth, was born on February 6, 1808. After graduating from Edinburgh in 1830, he entered the service of the East India Company.[61] In 1845, Esdaile was in charge of the Native Hospital at Hooghly, India. Having read reports of Elliotson's activities, he was inspired to try mesmerism in a surgical case. On April 4, 1845, he performed his first operation on a mesmerized patient. Encouraged by his success in this case, Esdaile continued his experiments,

[59] Paul F. Eve, "Mesmerism—A Lecture delivered in the Medical College of Georgia (by request of the Students), Feb. 18th, 1845," *South. Med. and Surg. Jour.* 1 (n.s. 1845) 167–92.

[60] L. A. Dugas "Remarks on a Lecture on Mesmerism, published in the 4th No. of the Southern Medical and Surgical Journal," *South. Med. and Surg. Jour.* 1 (n.s. 1845) 236–45; Dugas, "Extirpation of a schirrous Tumor, the patient being in the Mesmeric state, and evincing no sensibility whatever during the operation," *ibid.* 1. 508–10.

[61] Bramwell, *op. cit.* (see note 8) 14.

and by January 22, 1846 he reported 73 cases.[62] The nature of these cases is seen from the following list prepared by Esdaile:

A Return,

Showing the number of painless surgical operations performed at Hooghly during the last eight months.

Arm amputated	1
Breast ditto	1
Tumor extracted from the upper jaw	1
Schirrhus testium extirpated	2
Colis amputated	2
Contracted knees straightened	3
Ditto arms	3
Operations for cataract	3
Large tumor in the inguen cut off	1
Operations for Hydrocele	7
Ditto Dropsy	2
Actual cautery applied to a sore	1
Muriatic acid ditto	2
Unhealthy sores pared down	7
Abscesses opened	5
Sinus, 6 inches, laid open	1
Heel flayed	1
End of thumb cut off	1
Teeth extracted	3
Gum cut away	1
Praeputium cut off	3
Piles ditto	1
Great toe nails cut out by the roots	5
Seton introduced from ankle to knee	1
Large tumor on leg removed	1
Scrotal tumors, weighing from 8 to 80 lbs. removed 17, painless	14
Operations	73

Further reports of operations performed under mesmerism by Esdaile and others appear in the same volume of the *Zoist*;[63] but it also contains

[62] "More Painless Surgical Operations in the Mesmeric State. Communicated by Dr. Elliotson" *Zoist* 4 (1846–47) 193–218. The first report on Esdaile's work was contained in the paper "Surgical Operations without Pain in the Mesmeric State," *Zoist* 3 (1845–46) 380–89. Further reports were published in "More painless Amputations and other Surgical Operations in the Mesmeric State," *ibid.* 3. 490–508; "Accounts of more painless Surgical Operations." Communicated by Dr. Elliotson, *ibid.* 4.

[63] "Postscript, by Dr. Elliotson, to the Account of Painless Surgical Operations," *Zoist* 4 (1846–47) 284–91; "More painless Surgical Operations in the Mesmeric State. Communicated by Dr. Elliotson," *ibid.* 4 293–333; "Still more Mesmeric News from India, and Surgical Operations. Communicated by Dr. Elliotson," *ibid.* 4. 412–33; "More painless Surgical Operations. Report of a Committee at Calcutta in favor of the truth

an account of the successful use of ether for surgical anesthesia in Boston.[64] "Dr. Ashburner has favored me," says Elliotson, "with the following extract from a letter written in America to Miss Edgeworth, who communicated it to him:—

'With us here in Boston a new adaptation of gas from ether removes all sensibility to pain from the most fearful surgical operations. It is a blessing to the human race unequalled since the first application of vaccination. I speak decidedly, for it has within the last month been so repeatedly tested without failure in our admirable hospital by skilful surgeons, that it is an accredited fact. It is gas from ether, inhaled through the mouth, which produces a tranquil, dreamy state, an entire inaction of the muscular system, a total insensibility to pain, but a slight perception of sound, which enters into this sort of dream that is passing through the mind. It being necessary to take out two of Lizzie's large double teeth three weeks since, I asked to have this gas applied first, having heard of its power only a few days before. They were both taken out with an interval of only five minutes, and she was conscious of nothing but the placing of the instrument and the sound of her father's steps as he walked up and down the room. She suffered *no pain* at the time nor afterwards. It leaves no effect except a sort of drowsiness which passes off in a few moments. At the hospital large tumors have been removed, limbs have been amputated, the patient perfectly unconscious, the flesh and muscles perfectly still, no twitching, no contracting. In one case of amputation, the woman began to rouse at the tying of the last artery, and said she felt something pinch her. Another, waking when all was done, asked impatiently why they did not begin—what they were waiting for.

'It was first applied in this manner by a practical and very skilful chemist in this town of the name of Jackson, and explained by him to a young dentist, who applied for some means to manage a refractory patient. He tried it on himself first, and was so delighted with its effects, that he sent out to hire some one to have a tooth drawn after taking it, for five dollars. Since then his room has been crowded.' "

Elliotson states that ether is the substance employed, and describes how it is administered. His attitude to the new anesthetic is generally favorable, but already contains a hint of the position which he, Esdaile, and the other advocates of mesmerism in surgery would take later. "If this plan produces insensibility to pain in more instances than mesmerism, and quite as innocently and easily as when mesmerism succeeds it will indeed be a blessing, and none will hail it more joyously than we mesmerists, who have no other object than the good of mankind. . . . " But, in any case, credit should be given where it is due, for according to Elliotson:

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and utility of Mesmerism. New mode of inducing Coma, and the Conversion of the Profession to the Duty of Preventing Pain in Operations. By Dr. Elliotson," *ibid.* 4. 563–583.

[64] *Zoist* 4 (1846–47) 576–83.

To mesmerism and mesmerisers all this is really owing. The idea of proving insensibility for operations had through mesmerism laid such hold on nen that the trial of inhaling ether was made; and the success of mesmerism will drive the profession headlong to try the new method and too generally, as evidently in the case of Mr. Liston, out of a desire to "supersede" mesmerism. . . . The truth unsuspected by Messrs. Liston, Wakley, Boott, and the rest of the eager anti-mesmerists, is, that the state induced by ether is somnambulism—*the very same state as the mesmeric*—which varies from deep coma to more or less partial activity of brain. . . . My triumph has now arrived. The first operation in the sleep-waking state thus artificially induced has been performed in the hospital from which mesmerism was banished, and by the surgeon who was most violent against it and leagued with Mr. Wakley.

In the meantime, Esdaile having placed the results of his first hundred operations before the authorities in India, the Governor General of Bengal appointed a committee to investigate the matter. On the basis of the report rendered by the committee it was decided "to place Mr. Esdaile for a year in charge of a small experimental hospital, in some favourable situation in Calcutta, in order that he may . . . extend his investigations to the applicability of this alleged agency to all description of cases, medical as well as surgical, and all classes of patients, European as well as Native."[65] The report presents an interesting picture of the manner in which mesmerism was practiced in Esdaile's Hooghly Hospital.

The patients treated were all native males, from 18 to 40 years old, Hindoos and Mahomedans, in all conditions of general health from extreme emaciation to ordinary strength . . . . The mesmerisers employed by Dr. Esdaile were young men, Hindoos and Mahomedans, from 14 to 30 years of age, most of them compounders and dressers from the Hooghly Hospital.

To each patient a separate mesmeriser was assigned. The room in which they operated was darkened, but from time to time the Committee were enabled to witness, through small apertures made in the door panels, the manner in which the processes were carried on. The patient lay on his back, the body naked from the waist upwards, and the thighs and legs bare; the mesmeriser seated behind him at the head of the bed, leaning over him, the faces of both nearly in contact, the right hand being generally placed on the pit of the stomach and passes made with one or both hands along the face, chiefly over the eyes. The mesmeriser breathed frequently and gently over the patient's lips, eyes and nostrils. Profound silence was observed. These processes were continued for about two hours each day in ten cases, for eight hours in one case in one day, and for six hours in another case, without interruption. Three cases of the ten . . . were dismissed without satisfactory effect.[66]

[65] Bramwell, *op. cit.* (see note 8) 15.

[66] "Report of the Committee Appointed by Government to observe and report upon Surgical Operations by Dr. J. Esdaile, upon patients under the influence of alleged mesmeric agency. Printed by order of the Deputy Governor of Bengal. Calcutta, 1846," *Zoist* 5 (1847–48) 51–52.

FIG. 3. Robert Liston, aged 30.

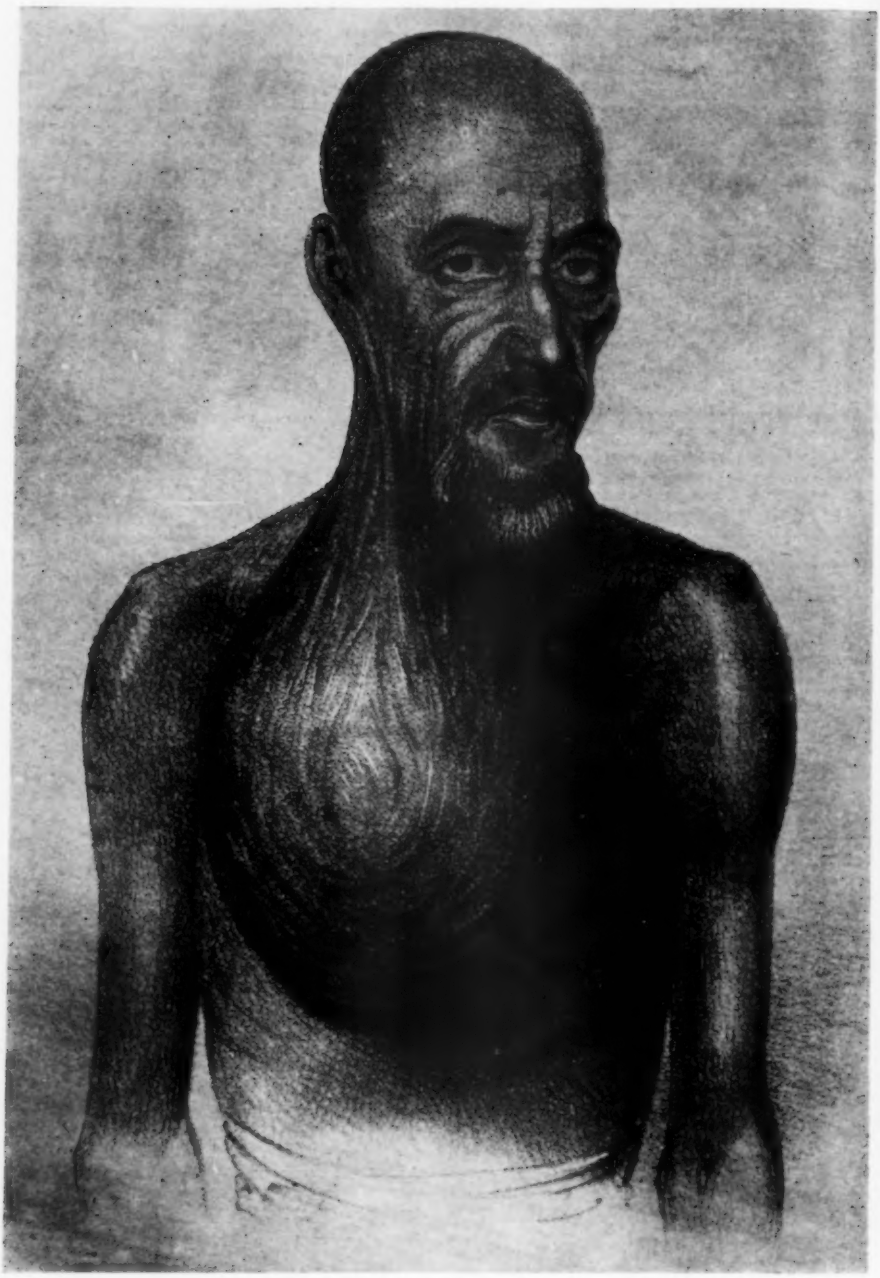

FIG. 4. A picture of the tumor removed by Allan Webb under mesmerism. (The tumor had been growing for ten years and weighed five pounds.)

In November, 1846, a small hospital in Calcutta was placed at Esdaile's disposal. Here he worked for one year (until December, 1847). In the first monthly report of the Calcutta Mesmeric Hospital, Esdaile reported his trial of ether as a surgical anesthetic.[67] His conclusion was:

> By cautious and graduated doses, and with a knowledge of the best antidotes, I think it extremely probable that this power will soon become a safe means of procuring insensibility, for the most formidable surgical operations even.
>
> All mesmerists, who are lovers of truth, and not mere traders, will rejoice at having been the means of bringing to light one truth more, especially as it will free them from the drudgery required to induce mesmeric insensibility to pain, which, although the most striking, is the least important branch of the subject.
>
> It is only of late years that the application of mesmerism to surgery has been prominently brought forward, principally with the view of affording an ocular demonstration of this great vital agent.
>
> But the great field for a display of its usefulness is in the treatment of medical diseases, where it often comes to our aid when all other resources have failed.

This passage is extremely revealing and significant. It emphasizes that mesmerism failed to persist as an anesthetic agent, not only because of the opposition to it, but also, and this may have been even more important, because it was less efficient than ether or chloroform. The margin of uncertainty in producing anesthesia was much greater with mesmerism. Confirmation of this point may be found in the comment of Dr. Gregory, also an advocate of mesmerism, contained in a letter (November 23, 1847) to the *Zoist*. "It is true," he says, "that the more tangible agents, ether and its fellows, possess one advantage, namely, that of superior certainty, inasmuch as it is not every one subjected to a surgical operation nor every parturient female, that can be brought under the influence of mesmerism."[68] Furthermore the process of mesmerizing was laborious and time-consuming, and was therefore not suited for emergencies. Finally, the advocates of mesmerism were interested in its surgical application chiefly for propaganda purposes, as demonstrating the existence of mesmeric force. With the appearance of superior agents, ether and chloroform, interest in the surgical use of mesmerism declined, although its medical use persisted.

News of Esdaile's exploits was not restricted to mesmeric circles in Britain, but also spread to the Continent. On April 28, 1847 the *Allgemeine*

[67] "Dr. Esdaile's First Monthly Report of the Calcutta Mesmeric Hospital, and his Experiments with Ether used with the same view as Mesmerism in Surgical Operations. Painless Operation at Madras, By Dr. Johnstone, upon a European lady, in the Mesmeric State. Appointment of a Mesmeric Committee at Madras by the Government. Communicated by Dr. Elliotson," *ibid.* 5. 178–97.

[68] "On the probability of the discovery of Physical Agents able to produce the Mesmeric State." By Dr. Gregory, *ibid.* 5. 380–82.

Medicinische Central-Zeitung reported briefly on Esdaile's mesmeric operations, adding comments by two German physicians, Justinus Kerner and Joseph Ennemoser.[69] The former expressed his belief in the truth of the report, but felt that mesmerism was only of limited use as a surgical anesthetic. Ennemoser was more sanguine in his opinion, feeling that mesmerism was much to be preferred to ether. Only if the patient could not be put to sleep by mesmerism should ether be used. Particularly in the case of patients who were seriously ill and weak, everything should be tried to avoid using ether. Finally, Ennemoser expressed the hope that it would not be long before magnetism will be found to be of equal if not greater interest in the treatment of patients with mental disease.[70]

In India, meanwhile, Esdaile zealously continued his activities. At the end of 1847, the medical officers appointed to inspect the Mesmeric Hospital reported that even in the severest operations mesmerized patients were completely insensitive to pain. Despite the favorable report, however, the Mesmeric Hospital was closed. On September 1, 1848, a second hospital supported by voluntary contributions was opened, and Esdaile was placed in charge. This hospital was closed six months later when Esdaile was appointed to the Sukeas Lane Hospital and Dispensary, where he combined mesmerism with the ordinary practice of medicine. Here he carried on his work until he left India for Scotland in 1851.

Reports of his accomplishments appeared regularly in the *Zoist*.[71] Up

[69] *Allgemeine Medicinische Central-Zeitung* 16 (1847) 261–62. It is noteworthy that Kerner's contact with mesmerism began in childhood when he was cured by mesmeric treatment of a stomach complaint. The story is to be found in Kerner's autobiography, *Das Bilderbuch aus meiner Knabenzeit. Erinnerungen aus den Jahren 1786 bis 1804* (Braunschweig 1849, also Stuttgart 1886). Animal magnetism played a significant role in German Romantic science, and a study of the use of mesmerism in German medicine would undoubtedly prove of great interest. The reader may refer to the following sources: Ricarda Huch, *Die Romantik (Ausbreitung und Verfall der Romantik)*, 6th and 7th edition (Leipzig, H. Haessel, 1920) 2. 264–95; Werner Leibbrand, *Romantische Medizin* (Hamburg-Leipzig, H. Goverts Verlag, 1937) 119–44; C. Bernoulli, and H. Kern (editors), *Romantische Naturphilosophie* (Jena 1926) 77–98.

[70] On June 2, 1847, a scathing reply to these remarks appeared in the same journal, *Allgemeine Medicinische Central-Zeitung* 16 (1847) 343. I owe this reference and the preceding one to Dr. Curt Proskauer, who very kindly called them to my attention.

[71] "Report by Dr. Elliotson upon 'A Record of Cases treated in the Mesmeric Hospital from November, 1846, to May, 1847, with the Reports of the Official Visitors. Printed by Order of Government, Calcutta. W. Ridsdale, Military Orphan Press, 1847,' " *Zoist* 6 (1848–49) 1–42; "Triumph and Reward of Dr. Esdaile," *ibid.* 6. 113–20; "Account of a Record of Cases treated in the Mesmeric Hospital, from June to December, 1847; with Reports of the Official Visitors. Printed by Order of the Government. Calcutta, 1848,' by John Elliotson," *ibid.* 6. 121–58; "Dr. Esdaile's progress in India," *ibid.* 6. 393–99; "Reports of the Mesmeric Hospital Calcutta, by James Esdaile, Esq., M.D., Presidency Surgeon . . . ," *ibid.* 7 (1849–50) 24–41; "Report of the Calcutta Mesmeric Hospital for October, by James Esdaile," *ibid.* 7. 121–37: "Mesmerism and Chloroform in India," *ibid.* 7. 266–75; " 'Second half-yearly Report of the Calcutta Mesmeric Hospital. From 1st March to 1st September,

to the time of his departure from India, Esdaile performed several thousand operations on mesmerized patients; of these about three hundred were major operations, including amputations, lithotomy, removal of scrotal tumors, hydrocele, and cataract. These achievements were reported by Esdaile in several publications issued while he was still in India: "Mesmeric Feats," *India Journal of Medical and Physical Science* (1845); *Mesmerism in India, and its Practical Application in Surgery and Medicine* (1846); *A Record of Cases Treated in the Mesmeric Hospital, from November, 1846, to December, 1847, with Reports of the Official Visitors, Printed by Order of the Government* (Calcutta 1847).

During this period the mesmerists became increasingly hostile to the use of ether and chloroform as anesthetics. This hostility was ostensibly based upon the greater safety of mesmerism as an anesthetic agent. In part the claim was no doubt true. The use of these new and little understood anesthetic agents was followed at first by dangerous and disagreeable consequences. This was pointed out in the *Zoist* in 1849:

> As our own pages abundantly prove, all the returns are in favor of the production of insensibility by means of mesmerism, and against the induction of the state by means of ether, chloroform, &c. In no one instance has a fatal result ensued from the use of mesmerism: in how many cases have ether and chloroform produced instant death, or induced symptoms which have not disappeared for days, weeks, and even months? The natural conclusion is this—in any case of surgical operation, mesmerism should first be tried; if that fails, or the time permitted is not sufficient to induce the required state, then the propriety of using the other methods may be taken into consideration.[72]

Similar views as to the greater safety of mesmerism were expressed in other accounts published in the *Zoist*.[73]

Nevertheless, the cause of the mesmerists was a lost one. While reports of surgical cases operated under mesmerism continued to appear after 1850, most of these were minor, comprising dental extractions, incision of abscesses, and normal obstetrical deliveries.[74] Only two accounts of major operations were published in the *Zoist* between 1852 and 1856. One of

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1849.' With a Letter published in the Calcutta Star from a Visitor to the Hospital; and a private letter from Dr. Esdaile to Dr. Elliotson. Communicated by Dr. Elliotson," *ibid.* 7. 353–68; "Mesmerism in India in 1850." Communicated by Dr. Elliotson, *ibid.* 8 (1850–51) 189–94; "Mesmeric News from India in the present Quarter." Communicated by Dr. Elliotson, *ibid.* 8. 229–37; "Dr. Esdaile's return to England." By Dr. Elliotson, *ibid.* 9 (1851–52) 313–16.

[72] "Introduction to the Seventh Volume of the Zoist," *Zoist* 7 (1849–50) 8.

[73] *Zoist* 7 (1849–50) 266–75, 368–89.

[74] *Zoist* 8 (1850–51) 178–89; *ibid.* 9 (1851–52) 76–77; *ibid.* 9 (1851–52) 302–304; *ibid.* 10 (1852–53) 299–303; *ibid.* 11 (1853–54) 53–57.

these was the removal of a tumor from the neck of an Indian native, in the course of which the carotid artery and the jugular vein were exposed (Fig. 4). This case is described in a letter addressed to Elliotson by Allan Webb, the author of *Pathologia Indica, or the Anatomy of Indian Diseases* . . . (Calcutta 1848), who succeeded Esdaile as director of the Mesmeric Hospital in Bengal.[75] The other operation was the removal of a breast, performed at the London Mesmeric Infirmary on April 26, 1854 by W. J. Tubbs, a surgeon of Upwell.[76] This is the last operation recorded in the *Zoist*, for on December 31, 1855 the journal ceased publication after having completed Volume 13. In conclusion, the editor pointed out that "The object for which *The Zoist* was undertaken is obtained."

> That object was neither pecuniary gain nor worldly reputation: for loss was very nearly certain; contempt, ridicule, virulent abuse, and serious injury, were all inevitable. It was the establishment of truths, splendid, exquisite, extensive in their bearings, and of the highest importance to the moral and corporeal well-being of mankind. . . . We have recorded *all* the glorious doings of Dr. Esdaile in India, and all the painless operations performed elsewhere up to this hour, so far as we know of them.[77]

Obviously, by the middle of the 'fifties mesmerism and surgery had come to a parting of the ways. Unable to compete with the more efficient chemical anesthetics, the use of mesmerism in surgery lost such significance as it had achieved. (It may be mentioned in passing that with the revival in England of interest in hypnotism at the end of the nineteenth century, it was once again demonstrated that surgical procedures could be performed on mesmeric patients.)[78]

Finally, there are two aspects of the mesmeric movement that merit

[75] "An Account of the Mesmeric Hospital in Bengal since Dr. Esdaile's Departure from India," *Zoist* 10 (1852–53) 278–93. Webb was a former student of Elliotson, and in the letter gratefully recalls his teacher's kindness: "I dare say," he writes, "it is quite possible that you may find some difficulty in making out by recollection your ancient *vis-à-vis* neighbour at Mr. Alcock's in Burlington Street, of above twenty years ago, whom you used to take in your carriage to St. Thomas's and shew the use of the stethoscope, by induction upon the living and demonstration upon the dead, in diseases of the heart and chest. Twenty years have not effaced my gratitude to yourself. . . .

"Well, for six years I have followed you *here*, as I did with the stethoscope. I had risen *so* high in the clairvoyant estimation of my friend Esdaile that he made it a last request with the Governor that I should succeed to the mesmeric hospital. . . . Here is a statement of eight months practice at the hospital while under my charge."

[76] "An account of the perfectly painless and successful removal of a female breast in Mesmeric Sleep-waking at the London Mesmeric Infirmary by W. J. Tubbs, Esq., of Upwell, on April 26, 1854: with accounts of other instances of the same fact, and a list of operations performed equally without pain throughout the innocent and gentle agency of Mesmerism." By Dr. Elliotson, *Zoist* 12 (1854–55) 113–41.

[77] *Zoist* 13 (1855–56) 441–44.

[78] Bramwell, *op. cit.* (see note 8) 161–74; *Lancet* (April 5, 1890) 771.

mention. These are the fierce opposition that mesmerism encountered, and, related to this phenomenon, the organization of mesmeric hospitals and dispensaries. The origin of the opposition to mesmerism has been described above. The vigor of the anti-mesmerists continued unabated through the 'forties and 'fifties. The leaders of the anti-mesmerists were Thomas Wakley and John Forbes.[79] Mesmerism and its advocates were generally referred to in violently abusive language, or subjected to vulgar ridicule. Thus in the *Lancet* for October 29, 1842, Wakley declared: "Mesmerism is *too gross a humbug* to admit of any further serious notice. We regard its *abettors as quacks and impostors*. They ought to be *hooted out of professional society*." Even more savage was the attack upon Elliotson when, in 1846, his turn came to deliver the Harveian Oration.

> So then [Wakley thundered] the visionary follower of Mesmer, the bitter enemy of legitimate medicine, the professional pariah—he who for years has been performing such fantastic tricks as might well make the angels weep, is to stand in the place of honor, to assume the orator's robe . . . . Will [the Fellows] suffer one who in a trumpery publication has been slandering the profession for years, the hero of ribbald (*sic*) street ballads to represent them on this august occasion.

Elliotson's lecture was a dignified and eloquent presentation and defense of his views.[80] In the pages of the *Zoist*, however, Elliotson gave as good as he got; one example of his repartee should suffice:

> The fury of Mr. Wakley the leader of the British anti-mesmerists—the Holy Alliance of medical and chirurgical presidents and fellows of colleges, baronets, knights, archiaters, examiners, teachers, of fashionable and unfashionable, dashing and miserable, pure and not pure, physicians, surgeons, apothecaries and men-midwives, to hospitals, dispensaries and unions and without office at all, of dentists, cuppers, and chiropodists, from Sir Benjamin Brodie down to Elijah Drench of Rosemary Polygon and Miss Moucher of Tothill Fields . . . the fury, I say of the terrible coroner of all Middlesex, as soon as he found that I was appointed to deliver the Harveian oration in 1846, was something so awful, that apoplexy, palsy, and insanity were severally feared by his affectionate friends and admirers for several weeks during that glowing summer. His wild cries, are they not all preserved in the sacred pages of the virtuous *Lancet* of that memorable period, and faithfully copied into the accursed pages of the unholy Zoist for Jan. 1849?

Ironically, and yet with a possible feeling for the historical significance of these documents, Elliotson continued:

[79] For Wakley see footnote 27; for John Forbes see W. M. Gafafer, "John Forbes's British and Foreign Medical Review (1836–1847) and its Relation to Medical Statistics," *Human Biology* 6 (1934) 649, especially 638–41 and footnote 2 on p. 638.

[80] J. Elliotson, *The Harveian Oration, delivered before the Royal College of Physicians, London, June 27, 1846*. With an English version and notes, London, 1846.

They are: and great will be the help of these immortal works to the medical historians who shall live when we and mesmerism are no more to be found in any corner of the earth.[81]

While Elliotson and Esdaile were carrying on their polemic with those who, like Wakley, refused to regard mesmerism as anything but fraud, they did not overlook those who accepted mesmeric phenomena but rejected the theory of animal magnetism as a physical force. Among these was James Braid (1795–1860), a surgeon, who was educated at Edinburgh and practiced at Manchester for most of his life. Braid became interested in mesmerism in 1841, and in 1843 published his *Neurypnology, or the Rationale of Nervous Sleep*. He did not accept the theory of animal magnetism; and used the term hypnotism in place of mesmerism. Braid attributed the phenomena to suggestion. Despite his interest, he performed few operations on mesmerized patients; these were chiefly dental extractions, incision of abscesses, and the like. In view of his theoretical position, it is not to be wondered at that there are few references to him in the *Zoist*, and most of these are rather hostile.[82]

The exclusion of the practice of mesmerism from the regular hospitals made it necessary for the medical mesmerists to have their own institutions. The first steps to establish such an institution were taken on July 9, 1846 at a meeting held at the home of the Earl of Ducie.[83] Those attending "being convinced of the vast benefits derived from Mesmerism in the Cure of Diseases even the most intractable, and being desirous that its benefits should be more widely extended to the Poor Classes than individual exertion can accomplish, *Resolved*—1. That with this view a Mesmeric Infirmary shall be established by voluntary contribution for the cure of Diseases and the prevention of pain in Surgical Operations . . . . " It was not until March 1850, however, that the London Mesmeric Infirmary was finally established at No. 9, Bedford Street, Bedford Square.[84] At about the same time a Mesmeric Institute was opened in Bristol.[85] A Mesmeric

[81] "An account of the deadly blows dealt, in the very presence of the President and whole College of Physicians, upon all the mesmerists of the earth in their absence, by the valiant Dr. John Arthur Wilson, a physician of St. George's Hospital, in his late right comical Harveian Oration. By John Elliotson, M.D., Cantab, F.R.S. &C., one of the sufferers, and not likely to recover," *Zoist* 8 (1850–51) 271–82.

[82] See e.g. "Stray notes upon the article on Electro-Biology, Mesmerism, &C. in the Quarterly Review. By Anti-Glorioso," *Zoist* 11 (1853–54) 390–403.

[83] Mesmerism, like various other medical "heresies," attracted to its banner numerous intellectuals and persons of high social standing. A more recent example may be seen in the earlier history of Freudianism. See *Zoist* 6 (1848–49) 423.

[84] *Zoist* 9 (1851–52) 124.

[85] *Zoist* 7 (1849–50) 152–64; *ibid.* 8 (1850–51) 211–20.

Institution was likewise established at Exeter, and J. B. Parker, Surgeon, reported that he had "performed upwards of two hundred surgical operations without the patients feeling pain, whilst under the influence of mesmerism, including twenty most painful operations on the eye, tying the radial artery, more than one hundred bleedings, cutting off a very painful wart, and the extraction of *forty teeth* . . . . "[86]

The Bristol Institute did not last very long, for in 1852, the *Zoist* reported that it had ceased to exist. The same year, however, saw the appearance of the Dublin Mesmeric Association and the Dublin Mesmeric Infirmary.[87] None of these establishments was long-lived; when the Scottish Curative Mesmeric Association was formed in 1854, Elliotson advised its supporters to "remember that similar attempts in Dublin, Bristol and Exeter have failed. . . . "[88]

The creation of these establishments did not fail to arouse the ridicule of the anti-mesmerists. When the plan for the London Mesmeric Infirmary was announced, the *Lancet* greeted the news by publishing the following "poetic" effusion:[89]

THE MESMERIC HOSPITAL

To the Editor of the Lancet

Sir—

It appears from your last, as I erst had suspected
That a Mesmeric Hospital's to be erected;
And if the subscriptions pour in pretty fast,
The scheme will perhaps be accomplished at last.
Dr. E. will of course be the leading physician!
A man of acknowledged and vast erudition,
Well versed in the art; and the cream of the joke is,
He has booked for the nurses the two little Okeys.
Then away with examiners, drugs and degrees;
Away with old fashions, excepting the fees;
Away with the *Hall*, and away with the *College*;
Away with chirurgo-medical knowledge;
The "passes" will act like the wand of a fairy,
For Mesmer's the "grand plenipotentiary."
All the hospitals' heads will be hid and diminished,
The moment this foetal Mesmeric is finished,
And paupers, in future will learn to despise,
King's College, The London, St. George's and Guy's.
No more shall we hear the afflicted complain,
Operations will give more of pleasure than pain;

[86] *Zoist* 9 (1851–52) 206–207.
[87] *Zoist* 10 (1852–53) 158–67, 218–21.
[88] *Zoist* 12 (1854–55) 108–11.
[89] *Zoist* 8 (1850–51) 273.

> And ladies will smile in their mesmerised trance
> As the pains of their uterine efforts advance.
> Then shut up the schools, burn the Pharmacopoeia,
> Let us carry out all Dr. Mesmer's idea:
> And whilst skeptics their agonized vigils are keeping
> His disciples will through their afflictions be sleeping.

I have been unable to determine how long the London Mesmeric Infirmary continued in existence; perhaps some reader in England knows the answer. In 1853 the Infirmary was moved to No. 1A, Fitzroy Square; and in 1854 to No. 36 Weymouth Street. The operation of this institution will not be discussed at present, but will be taken up in a later paper. The story of mesmerism in surgery may now be concluded. James Esdaile died on January 10, 1859, at the age of fifty. Elliotson outlived him by nine years, dying in 1868, an old man of eighty.

In this paper we have considered in some detail only mesmerism and surgery. Other interesting aspects of the mesmeric movement of the early nineteenth century have been touched upon very briefly or not at all. A sociological study of the mesmeric movement as a medical sect would undoubtedly be of great interest. From the facts presented above, however, certain conclusions may be drawn: 1. The advocates of mesmerism in surgery attracted attention to the possibility of a really painless surgery and thus helped to prepare the way for an acceptance of ether and chloroform. This was true even in the case of those who opposed mesmerism. Consider, for example, Liston's remark that "this Yankee dodge beats mesmerism hollow." 2. The advocates of mesmerism with their propaganda kept alive the interest in this subject, and thus paved the way for its study during the latter part of the century.

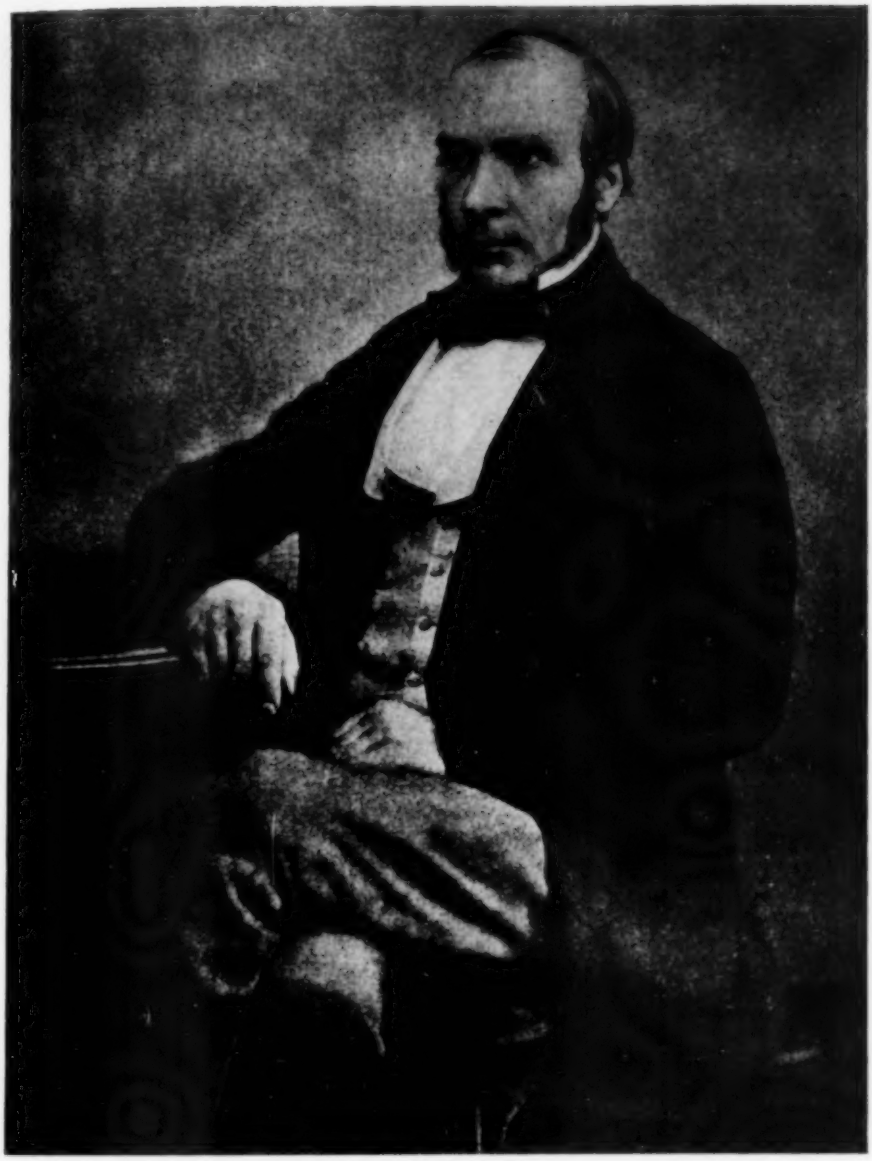


FIG. 1. John Snow. "He was of middle size, and some years since, slender; but of late he had become slightly fuller build."—Richardson. (Portrait reproduced from *Asclepiad*, 1887, vol. 4.)

QUÆ PROSUNT OMNIBUS ARTES
Know all Men by these Presents:
That We, the Court of Examiners of the Royal College of Surgeons in London have deliberately Examined Mr. John Snow and have found him to be fit, and capable to exercise the Art and Science of Surgery:
We, therefore, admit him a Member of the College, and authorize him to Practise the said Art and Science accordingly.
In Witness whereof We have subscribed our Names, and have caused the Common Seal of the College to be affixed hereunto.
Dated the Second Day of May in the Year of our Lord, One Thousand Eight Hundred and Forty Eight
Anthony Carlisle President
Hon. Leigh Thomas
Rob. Keate Vice-Presidents:
Astley Cooper
John Gaitskell Assistant
Samuel Cooper
Enrolled by Edm. Belfour Sec.

FIG. 2. John Snow's diploma certifying his membership in the Royal College of Surgeons, London. (Reproduced through the courtesy of Dr. Ralph M. Waters, who possesses the original.)

John Snow, M.D., Anesthetist

THOMAS E. KEYS*

IF A POLL were taken among anesthetists concerning who among these several renowned gentlemen was the most outstanding, John Snow (Fig. 1) would undoubtedly be among the first two or three selected. First of all, Snow was the *alpha* of the physician anesthetists. Morton might also be considered, since he gave up his medical career as a student at Harvard as well as his dental practice to devote full time to the new specialty. But Morton complicated his position by his many attempts to patent "Letheon" and his later attempts to gain money, which to this day have left an unfavorable impression.[1] On the other hand, Snow was not especially interested in money. According to Richardson,[2] his highest annual income amounted to £1,000. For this he administered about 450 anesthetics yearly for an average of ten years preceding his death. In many of these cases he supplied his services gratis. Furthermore, Snow placed no restrictions on the manufacture of his apparatus.[3] He encouraged others to build anesthetic equipment based on his own models which in his hands made possible a safe production of ether and later chloroform anesthesia.

Many members of the medical profession unfamiliar with his contributions in anesthesiology have remembered Snow's investigations of cholera. Indeed, at least one biographer[4] believes that his chief title to immortality lies in the work he did in unraveling its mysteries. In 1848, some thirty-five

* Librarian, Mayo Clinic.

[1] Contemporary medical opinion was decidedly not in favor of Morton's desire to patent "Letheon." Dr. J. D. Mansfield of South Reading, Mass. was sharply critical, and suspected that the preparation was sulphuric ether. See Mansfield's letter published in the *Boston Med. and Surg. Jour.* 35 (1846) 424–25. Drs. George Hayward and John Collins Warren were firm in their opinion that the new anesthetic agent should not be patented. Finally, Dr. Henry Jacob Bigelow as expeditiously as possible announced to the medical world the anesthetic properties of sulphuric ether. Bigelow's first paper was read before the Boston Society of Medical Improvement on November 9, 1846, just 24 days after Morton's public demonstration. Eight days later it was published in the *Boston Medical and Surgical Journal*. Morton, to be sure, made great financial sacrifices and had his supporters in two noted lawyers, Charles M. Keller and Daniel Webster. See Morton's *Letheon* (5th ed., Boston, May 1847).

[2] B. W. Richardson, "John Snow, M.D., a Representative of Medical Science and Art of the Victorian Era," in *Snow on Cholera* (New York, The Commonwealth Fund 1936) xlvii.

[3] John Snow, *On the Inhalation of the Vapour of Ether in Surgical Operations; Containing a Description of the Various Stages of Etherization and a Statement of the Result of Nearly Eighty Operations in which Ether has been Employed in St. George's and University College Hospitals* (London 1847) 23. See also p. 17 for a description of his first apparatus.

[4] Heroes of Medicine: "Pioneers of Anaesthesia IV. John Snow," *Practitioner* 57 (1896) 412–16.

any more complications in Snow's health until his fatal illness.

Meanwhile, in America, a drama was being enacted that later was to prove of utmost consequence to the medical world. After the earlier pioneer efforts of others, Morton successfully demonstrated the practical value of ether anesthesia on October 16, 1846, in Boston. It seems most remarkable, as we look back on this historic moment, that this important intelligence was transmitted so rapidly to Europe. On December 15, 1846, ether was first administered in Paris,[11] and on December 19 it was successfully introduced for a dental extraction in London.[12] Dr. Francis Boott had heard about ether from Dr. Bigelow, who had written him from Boston. The extraction took place at Dr. Boott's residence. Mr. Robinson of Gower Street performed the extraction; he also served as anesthetist. The patient was a Miss Lonsdale. On December 21, 1846, anesthesia was assured a prominent place in medical practice when Robert Liston[13] performed his first two operations in which the patients were under the influence of ether anesthesia. William Squire of Oxford Street was the anesthetist. The operations consisted of amputation of the leg at the thigh in one case and removal of a great toenail in the other.

The patient who underwent amputation was Frederick Churchill, a butler, who was then thirty-six. Amputation had become necessary because of septicemia that had been brought on about a month earlier by an examination of the diseased portion of the bone by Mr. Liston. The greatest surgeon of his day had unwittingly caused this infectious condition by examining the patient with unsterile hands and unsterile instruments! Even the discovery of anesthesia did not hasten surgical cure. Important as the introduction of anesthesia was in making surgical operations a relatively painless procedure, it contributed little if any benefit to the mortality rates from major operations. It was the introduction by Sir Joseph Lister[14] of scientific and systematic antisepsis and asepsis in the treatment of wounds and the performance of surgical operations, together with the application of surgical anesthesia, that revolutionized the practice of surgery and brought about the full benefit of making surgery the queen of the arts. Although others had proposed and used antiseptics of various kinds previous to Lister's notices in 1867 and 1868, it is to Lister that modern surgery owes a great debt, for he and he alone established the method on

[11] T. E. Keys, *The History of Surgical Anesthesia* (New York, Schuman's 1945) 29.

[12] Snow, *op. cit.* (see note 7) 78.

[13] F. W. Cook, "The First Operation under Ether in Europe," *Univ. Coll. Hosp. Mag.* 1 (1911) 127–44.

[14] J. S. Billings, "The History and Literature of Surgery," in F. S. Dennis, *System of Surgery* (Philadelphia 1895) 1. 103.

the basis of Pasteur's experiments showing that putrefaction is due to the action of micro-organisms. It was Lister, again, who systematically sought for and found means to prevent the access of these micro-organisms to wounds or to destroy them if they had already set up their infectious processes. The advent of anesthesia was a remarkable achievement, but because of the high mortality rates major operations were not undertaken, other than those in which there were obvious reasons to use the knife. These consisted chiefly of amputations and cutting for the stone.

Snow's monograph on ether appeared in September, 1847. He had previously, that same year, published three articles on his new experiences with sulphuric ether,[15] but it was in his ether monograph[16] that he first published his observations on the stages or degrees of anesthesia. Plomley,[17] a few months previously, had become the first to define three stages of anesthesia, but it is due to the pioneer efforts of John Snow that anesthesia was to be divided into the four well-known stages which continue to be recognized. The accepted stages are: (1) induction; (2) the stage of struggling or breath-holding, or delirium, or dreams; (3) surgical anesthesia; (4) over-dose, or stage of bulbar paralysis. In America the signs of anesthesia have been classified in relation to the four stages by Arthur Guedel.[18]

Snow made it perfectly clear on the first page of his ether monograph that the point requiring most skill and care in the submission of patients to anesthesia was the accurate determination of when anesthetization had progressed to the operative stage. Moreover, he suggested that these divisions were arbitrary, that they gradually ran into one another and were not always easy to distinguish. His "degrees of narcotism" as originally described were as follows:

In the first degree were included the various changes of feeling that a

[15] (*a*) "Observations on the Vapour of Ether, and its Application to Prevent Pain in Surgical Operations," *Lancet* 1 (1847) 227–28; (*b*) "On the Inhalation of the Vapour of Ether," *Lond. Med. Gaz.* 39 (1847) 498–502; 539–42; (*c*) "Inhalation of Vapour of Ether in Surgical Operations," *Lancet* 1 (1847) 551–54.

[16] See note 3, above.

[17] Francis Plomley, "Operations upon the Eye," *Lancet* 1 (1847) 134–35. Two early French physiologists also contributed the results of their investigations along these lines. Longet (*Arch. Méd.* March 1847, cited by Snow, see note 3 above) divided etherization into that of the cerebral lobes and that of the annular protuberance. Flourens (*Gaz Hôp.* March 20, 1847, cited by Snow, *ibid.*) recognized three degrees as follows: under ether the nervous centers lose their power in regular succession: (1) cerebral lobes, (2) cerebellum, (3) spinal marrow. Flourens pointed out that under anesthesia the medulla oblongata still retains its functions and the animal continues to live; with loss of power in the medulla oblongata life is lost.

[18] A. E. Guedel, *Inhalation Anesthesia; A Fundamental Guide* (New York, The Macmillan Company, 1937).

person may experience while he is still conscious of his surroundings and still able to direct his voluntary movements.

In the second degree mental functions may still be exercised, but in a distorted manner.

In the third degree there is no evidence of mental function and no voluntary motions.

In the fourth degree no movements are seen except those of respiration.

In the fifth degree (not witnessed in a human being) the respiratory movements are more or less paralyzed and become difficult, feeble, or irregular.

In his book on anesthesia written in 1858 John Snow elaborated on the "five degrees of narcotism." His fifth degree, which he observed in lower animals, was the first accurate description of the phenomenon of intercostal paralysis. Snow clarified this factor as follows:

> There are some further effects of chloroform with which one becomes acquainted in experiments on the lower animals. If the inhalation is continued after the symptoms just described are produced, the breathing is rendered difficult, feeble, or irregular, and is sometimes performed only by the diaphragm, whilst the intercostal muscles are paralyzed. If the dose of chloroform is gradually increased after these effects are produced, the breathing entirely ceases, but the heart continues to pulsate very distinctly, till its action becomes arrested by the absence of respiration, as in asphyxia.[19]

The phenomenon observed by Snow in 1858 in animals was brought to light in the clinical experiences of Albert H. Miller[20] of Providence, Rhode Island, in 1925. Dr. Miller was able to demonstrate the abdominal type of respiration which appears after a period of delayed thoracic respiration. If the anesthetic dose is further increased, paralysis of the costal muscles becomes more complete, and the condition of exaggerated abdominal respiration occurs.

Snow was most positive in his opinion as to the desirability of administering anesthetics with suitable apparatus. He saw the dangers of using an anesthetic sponge or a piece of gauze or a linen handkerchief, the common way of administering anesthetics. Morton had used an inhaler and Snow developed an improved one. Being a student of chemistry and physics, he readily ascertained that the proportions of air and anesthetic vapor cannot be determined without the use of some exact measurement of the quantity and quality of the anesthetic. He was especially concerned

[19] Snow, *op. cit.* (see note 7) 42.

[20] A. H. Miller, "Ascending Respiratory Paralysis under General Anesthesia," *Amer. Med. Ass. Jour.* 84 (1925) 201–202.

with the administration of chloroform, for he knew that chloroform was not without danger, since it was more powerful than ether. He knew that the proportions of air and anesthetic vapor necessary for anesthesia could be controlled by temperature and regulated by an apparatus that would force the patient to breathe the correct mixture. His apparatus was made of metal, the best conductor of heat, and placed in contact with water, the most convenient way of regulating temperature. Consequently, Snow figured out the law which determined the quantity of anesthetic vapor that air will take up and hold in suspension at various temperatures in order to regulate the strength of the vaporized air.[21]

At first, Snow's apparatus was equipped with a mouthpiece which did not enclose the nostrils. The patient was forced to breathe entirely by mouth. The apparatus generally succeeded, but some adult patients after losing consciousness instinctively tried to breathe through the nose. This forced air through the lachrymal ducts. Sometimes, moreover, the patients held back their breathing and became purple in the face, and when the nostrils were liberated to insure a liberal supply of oxygen, a delay in anesthesia was occasioned. Snow therefore modified his apparatus to include a facepiece. He adapted the facepiece invented by Dr. Francis Sibson of the Nottingham General Hospital which permitted inhalation by the nostrils as well as by mouth. Snow's modification of the facepiece and the rest of his apparatus continued in use and formed the basis for later anesthesia machines. For this reason it will be considered in detail.

Snow's chloroform inhaler as finally modified (Fig. 3) was made of metal and consisted of a double cylinder; the outer space contained water and the inner space served for the evaporation of chloroform which the patient was to breathe. In the inner part of the cylinder was a screwed frame having numerous openings for the admission of air, and four wires which descended nearly to the bottom of the space and were intended to support two coils of stout bibulous paper which were tied around them and reached to the bottom of the inhaler. Four notches were cut in the lower part of the paper to allow the passage of air as indicated by the arrows (Fig. 3). Since the quantity of chloroform added never filled the notches,

[21] Snow, *op. cit.* (see note 3) 29. The quantity of ether required to produce complete insensibility was found to vary from 6 fluid drams to 1 fluid ounce in the adult person and in children in the same proportions, according to their size. The quantity required to maintain insensibility during the operation was seldom greater than that which was used to induce anesthesia. The initial amount of chloroform used by Snow for anesthesia was from 2 to 2½ fluid drams. One dram of chloroform was absorbed by the filtering paper in the Snow apparatus; the rest remained at the bottom of the inhaler. One dram of chloroform was added from time to time as necessary (*ibid.* 84).

the air passing through the inhaler met with no obstruction. A glass tube communicated with the interior of the inhaler, passing to the outside. This enabled the anesthetists to tell when it was necessary to add more chloroform. The elastic tube connecting the inhaler to the facepiece was 3/4 inch in internal diameter. This allowed for the passage of as much air as it was possible for the patient to breathe.

The facepiece has already been described. Snow introduced two valves in the facepiece: one which rises on inspiration to admit the air and vapor from the inhaler and one which allowed the expired air to escape. The water bath supplied the heat which was rendered latent and carried off as the chloroform was converted into vapor to make inhalation steady and uniform. The bibulous paper was to insure that the air passing through would take up about 5 per cent of the chloroform vapor.

On November 10, 1847, James Young Simpson[22] read his first paper on the use of chloroform analgesia in obstetrics before the Medico-Chirurgical Society of Edinburgh. Simpson's method of administration was to pour a small amount of chloroform on a hollow sponge held over the mouth and nostrils. He was not particular about his sponge. A pocket handkerchief, a piece of linen, or a piece of paper also could be used.[23] Simpson did not attempt to explain the pharmacologic action of chloroform nor did it occur to him that his method might bring about harmful effects, for the dosage by his method could not be regulated. Indeed, Snow pointed out in his monograph[24] on chloroform the slovenly method of administration of chloroform as practiced in the Royal Infirmary at Edinburgh.[25]

Snow, sensing that, due to the influence of Simpson and because chloroform was a more potent agent, the tide of opinion among anesthetists was bound to favor the use of chloroform instead of ether, directed his immediate attention to chloroform. He pointed out, shortly after Simpson's introduction of chloroform, the greater strength of chloroform as compared to that of ether, and the extreme care required in its use.[26] This was the time also that he began his important studies "On Narcotism by the Inhalation of Vapours" in quest of a perfect anesthetic. These studies were

[22] J. Y. Simpson, "On a New Anaesthetic Agent, More Efficient than Sulphuric Ether," *Lond. Med. Gaz.* n.s. 5 (1847) 934–37; also, *Lancet* 2 (1847) 549–50.

[23] D. W. Buxton, "Snow's Work on Chloroform," *Brit. Jour. Anaesth.* 1 (1924) 149–58.

[24] Snow, *op. cit.* (see note 7) 74.

[25] James Miller, *Surgical Experience of Chloroform* (Edinburgh 1848) 16–17. According to Miller, "The object is to produce insensibility as completely and as soon as we can . . . whether it is done with 50 drops or 500 is unimportant."

[26] John Snow, "The New Letheon Agent," *Lancet* 2 (1847) 575–76; also, *Lond. Med. Gaz.* 40 (1847) 1031.

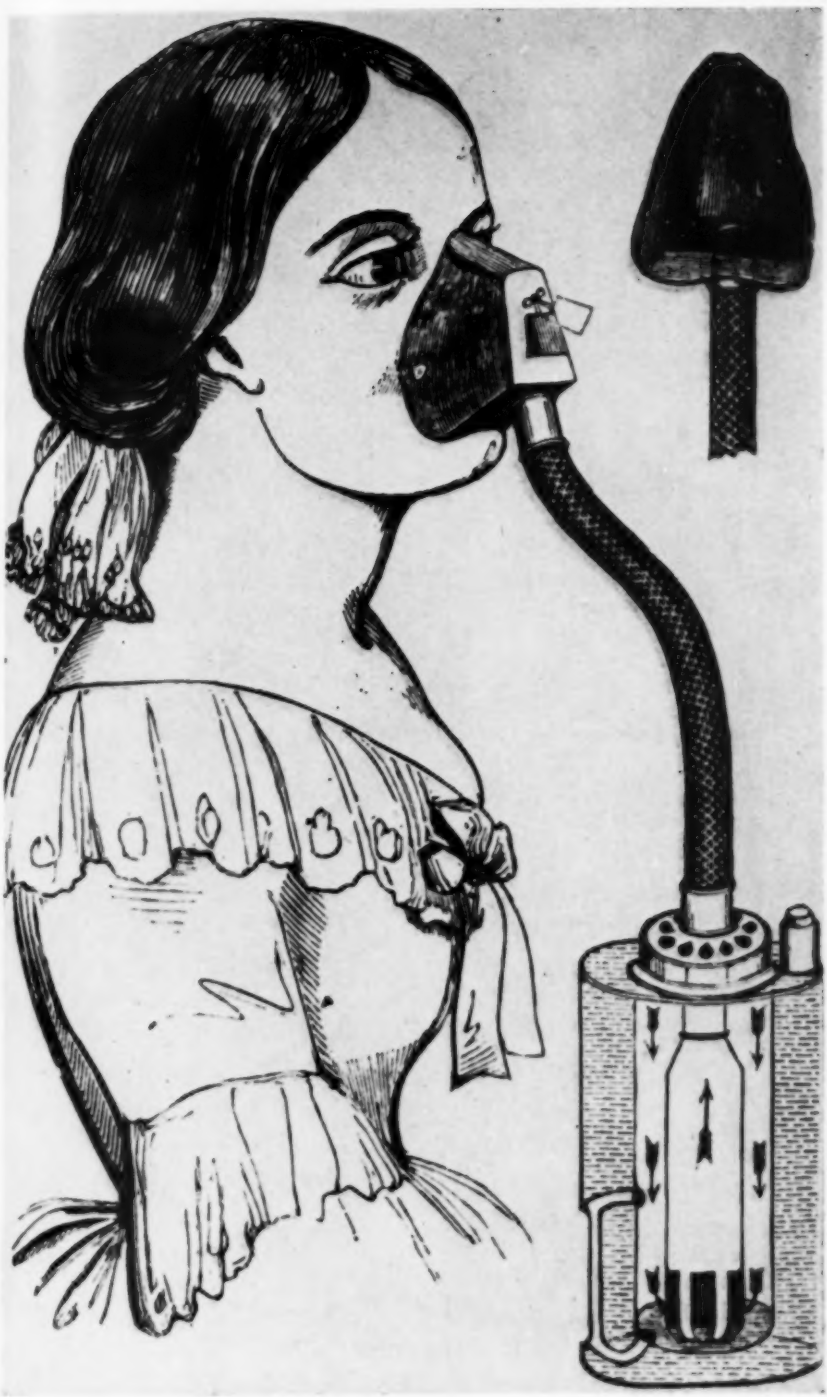
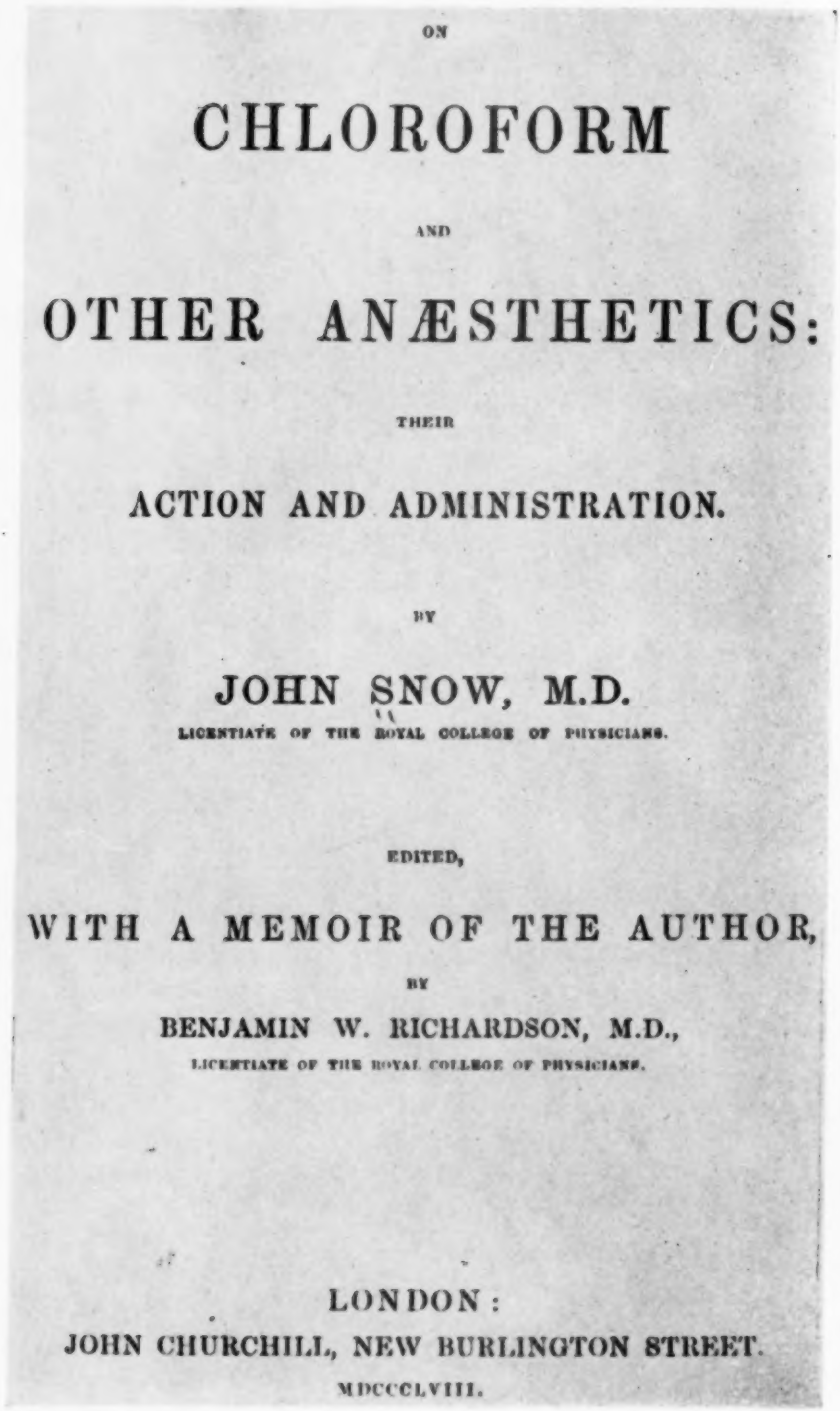


FIG. 3. The Snow chloroform inhaler. (Reproduced from his book, *On Chloroform and Other Anaesthetics*, London, Churchill, 1858. Courtesy the Boston Medical Library.)



ON

CHLOROFORM

AND

OTHER ANÆSTHETICS:

THEIR

ACTION AND ADMINISTRATION.

BY

JOHN SNOW, M.D.

LICENTIATE OF THE ROYAL COLLEGE OF PHYSICIANS.

EDITED,

WITH A MEMOIR OF THE AUTHOR,

BY

BENJAMIN W. RICHARDSON, M.D.,

LICENTIATE OF THE ROYAL COLLEGE OF PHYSICIANS.

LONDON:

JOHN CHURCHILL, NEW BURLINGTON STREET.

MDCCCLVIII.

FIG. 4. Title page to the first comprehensive textbook on anesthesia. (Courtesy the Boston Medical Library.)

published in the *London Medical Gazette* from 1848 to 1851.[27] He began with chloroform. He related the results of a great number of experiments performed on animals. He determined the proportion of various anesthetic vapors in the blood in the different stages of insensibility. He proved that the quantity of vapor in the blood necessary to cause any particular degree of anesthesia bore a constant relationship to the quantity that the blood would dissolve, and that this relationship was identical with respect to the different substances he had examined, including chloroform, ether, bisulphuret of carbon and other substances. He also proved what might readily be called "Snow's rule" on anesthetic vapors. That is, the more soluble a volatile substance was, the greater was the quantity required to produce a given effect. Consequently, when the volatility was taken into account, the strength of this class of substances was in inverse ratio to their solubility. He concluded that these substances did not become decomposed or enter into any chemical combinations in the body, but produced their effects by their mere presence, impeding those combinations between the oxygen in the arterial blood and the nervous tissues, on which the functions of the nervous system depend.

Snow's warnings concerning the possible dangers from chloroform anesthesia attracted little notice, however, until the first death from chloroform occurred near Newcastle on January 28, 1848. Snow[28] had again pointed out in the *Lancet* for February 12, 1848, the disadvantages of chloroform anesthesia. One of these disadvantages was the greater rapidity of its action as compared to that of other agents. Whereas ether required four to five minutes to produce its effect, chloroform was more rapid. This gave the surgeon little time to observe its effects, and might prove disastrous if, unwittingly, too much chloroform had been given to the patient. Snow felt that Simpson's method of administering chloroform in drops on a handkerchief was not at all satisfactory because the dose—that is, the proportion of the chloroform vapor and air—could not be accurately measured. Simpson recommended that one or two teaspoonfuls be placed on the hollow of a handkerchief and placed immediately on the face of the patient. This generally produced a snoring type of sleep. Snow had pointed out that this stertorous sleep was in reality the fourth stage of anesthesia, and

[27] John Snow, "On Narcotism by the Inhalation of Vapours," *Lond. Med. Gaz.* n.s. 6 (1848) 850; 893; 1074; n.s. 7 (1848) 330; 412; 614; 840; 1021; n.s. 8 (1849) 228; 451; 983; n.s. 9 (1849) 272; n.s. 10 (1850) 622; n.s. 11 (1850) 321; 749; n.s. 12 (1851) 622; n.s. 13 (1851) 1053; 1090. A collected reprint was issued of the first sixteen of these eighteen communications.

[28] John Snow, "On the Inhalation of Chloroform and Ether; With Description of an Apparatus," *Lancet* 1 (1848) 177–80.

that it was separated by only one stage from total cessation of respiration. Snow did not consider the fourth degree of anesthesia dangerous in itself, but chloroform possessed a cumulative effect, and he was afraid that in some cases anesthesia might proceed to this dangerous stage and result in disaster. Snow realized that ether was safer than chloroform but, weighing the disadvantages against the advantages of chloroform, concluded (1) that chloroform was less pungent and therefore more easily inhaled, (2) that chloroform occupied less space, therefore excluding less of the air breathed by the patient, and (3) that chloroform did not excite a profuse flow of saliva as ether sometimes does. He wrote: "I consider that, on the whole, chloroform is superior to ether for adults, and that we are greatly indebted to Dr. Simpson for the introduction of its use. For children I prefer ether to chloroform. . . . [Ether is] the less powerful agent of the two, however, and sufficiently strong for very young patients. . . ."[29]

Ralph Waters,[30] in his admirable summary of the accomplishments of John Snow, whom he considered to be the greatest of anesthetists, points out that Snow's acceptance of chloroform anesthesia was his great weakness. He allowed himself to be made an opportunist by public demand. Waters concluded: "Chloroform accomplished a beautiful induction for the surgeon to see and it was pleasanter for the patient to take. Against his better judgment he [Snow] did what was easier to do than to argue." But it should be remembered that in the capable hands of John Snow and with his use of his inhaler, Snow did not have any fatalities from chloroform, although in less capable hands deaths did occur. As Griffith[31] has shown, Snow, during the last ten years of his life, administered chloroform more than four thousand times with entire success, certainly an enviable record.

Snow felt that many deaths arising from the use of chloroform were due to placing the responsibility of production of anesthesia in the hands of incapable men. Richardson has captured Snow's attitude on this point in one of his amusing stories about John Snow:[32]

"There would be a great uproar," he [Snow] remarked on one occasion, "if a student were to undertake on the operating table to tie the femoral artery, and were to open the femoral vein. Yet at some of our hospitals, the administration of chloroform has been entrusted to the porter, who would only grin in ignorance, if informed that each time his services were required, he performed the grand act of suspending for a time the oxidation of the whole body, and of inducing a temporary

[29] *Ibid.*

[30] R. M. Waters, "John Snow, First Anesthetist," *Bios* 7 (1936) 25–40.

[31] H. R. Griffith, "John Snow, Pioneer Specialist in Anesthesia," *Curr. Res. Anesth. and Analg.* 13 (1934) 45–51.

[32] Waters, *op. cit.* 34; Snow, *op. cit.* (see, note 7).

death; and would tell you, if you asked him the composition of chloroform, that it was smelling stuff."

In spite of the fact that he recommended the unqualified use of his chloroform apparatus, Snow occasionally administered chloroform according to Simpson's technique. The most celebrated patient to whom he administered chloroform in this way was Queen Victoria, and the occasion was the birth of Prince Leopold on April 7, 1853. According to Richardson,[33] the chloroform was administered on a handkerchief in doses of fifteen minims; the inhalation lasted for fifty-three minutes. Snow previously had been consulted before the birth of Prince Arthur in 1850, but was not called on for his services. On April 14, 1857, he again administered chloroform to the Queen at the birth of Princess Beatrice.

The acceptance by Queen Victoria of chloroform analgesia assured its continued use in obstetrics. Many Englishwomen followed the Queen's example. Some of them tried to pry out of Snow what they could concerning the Queen's experiences and remarks. He always managed to sidestep the issue. One of these amusing occasions is related in detail by Richardson:

> One lady of an inquiring mind, to whom he was administering chloroform, got very loquacious during the period of excitement, and declared she would inhale no more of the vapour unless she were told what the Queen said, word for word, when she was taking it. "Her Majesty," replied the dry doctor, "asked no questions until she had breathed very much longer than you have; and if you will go on in loyal imitation, I will tell you everything." The patient could not but follow the example held out to her. In a few seconds she forgot all about Queen, Lords, and Commons; and when the time came for a renewal of hostilities, found that her clever witness had gone home to his dinner, leaving her with the thirst for knowledge still on her tongue.[34]

Snow's many experiences with the use of chloroform in obstetric cases led him to make several important observations.[35] No deaths arising from the method had been recorded in the literature. This was not surprising to Snow. In the first place, the effect to be produced was much slighter, so that not much chloroform needed to be given and chloroform was given only during the occurrence of severe pains.[36] In cases in which the pain was no

[33] Snow, *op. cit.* (see note 7) xxxi; Richardson, *op. cit.* (see note 2).

[34] Richardson, *op. cit.* (see note 2) xxxi–xxxii.

[35] John Snow, "On the Administration of Chloroform During Parturition," *Ass. Med. Jour.* n.s. 1 (1853) 500–502.

[36] When Simpson introduced the practice of chloroform inhalation in obstetrics he followed the usual plan in surgical operations of making the patient unconscious at once and keeping her "under" to the end of labor. Snow (see note 35) and a few of his contemporaries realized that this was not necessary, and that it might even be dangerous when labor was protracted.

greater than the patient was willing to bear cheerfully, the use of chloroform was not necessary, but when the patient was anxious to be spared the pain, Snow saw no objection to the use of chloroform. The kind of labor was not important, but the severity of the pain was the deciding factor. Snow generally began the administration of chloroform when the os uteri was nearly dilated to its full extent and when the pains were taking on an expulsive character.

As previously mentioned, the first death from chloroform occurred near Newcastle on January 28, 1848, a little more than two months after introduction of chloroform anesthesia. The unfortunate patient was Hannah Greener, a young girl of fifteen. The operation was a comparatively minor one. Sir James Simpson made the following comments:

> At last an alleged fatal case of its employment has been reported as having occurred in the practice of Mr. Meggison, of Winlaton, Newcastle; and a coroner's jury has returned a verdict of "Died from conjestion of the lungs, from the effects of chloroform."
>
> The unfortunate patient certainly died when under the influence of chloroform, not, however, as I believe, from its effects, but from the effects of the means used to revive her. . . .
>
> From the above extracts, it evidently appears that the girl fell into a state of syncope (becoming suddenly blanched, &c.) at the time of operating. The syncope might result from the operation, or from the chloroform, or from both. I have seen in a few cases such a blanched state of the lips and features come on, under the use of very powerful and deep doses of chloroform, simulating syncope, and with the respiration temporarily suspended; but these symptoms always readily disappeared, and the patients speedily recovered by simply removing the chloroformed napkin from the face, and letting them alone. And I most sincerely and conscientiously believe, that such also would have been the result in the present unfortunate instance, provided nothing more had been done. But with the best of motives and intentions water and brandy were poured into the girl's mouth. They were of course allowed to rest in and fill up the pharynx of the patient, as in her state of syncope and anaesthesia she was not in the condition to swallow them. The attempt at swallowing mentioned in the evidence was, I have no doubt, an attempt at breathing only, or at breathing combined with swallowing. But it was impossible for the patient, in her weak and torpid state, to inspire through a medium of water and brandy, any more than it would have been possible to inspire if the whole head and face had been inevitably submersed in the same fluid.[37]

To Simpson's statement Snow made a spirited reply:

> The recent fatal case of inhalation of chloroform appears to confirm in a melancholy manner the remarks contained in my paper in The Lancet on the 12th

[37] J. Y. Simpson, "Remarks on the Alleged Case of Death from the Action of Chloroform," *Lancet* 1 (1848) 175–76.

instant, respecting the danger arising from the cumulative property of the agent when administered on a handkerchief. The alarming symptoms came on after the cloth with chloroform was removed from the patient's face. Some of Dr. Simpson's observations on this case confirm the view I have taken. He says—"I have seen in a few cases such a blanched state of the lips and features come on, under the use of very powerful and deep doses of chloroform, simulating syncope, and with the respiration temporarily suspended." It may be presumed, that the cases Dr. Simpson has seen were under his immediate superintendence; and this makes the danger still more evident; for if any one could prevent his patient from getting into a state which cannot be looked on otherwise than as one of imminent peril, it would be the authority who introduced the agent, and recommended this method of its administration. . . .

I agree with Dr. Simpson, that it was not advisable to give brandy, or even water—the more so, as I do not think with him that there was syncope, but that these liquids caused suffocation, filling up the pharynx and being partially drawn into the larynx, seems improbable. . . . There is nothing in the reported evidence of the appearances on dissection which might not be caused by the kind of asphyxia liable to be induced when the effects of chloroform are carried too far; and these appearances are quite incompatible with Dr. Simpson's supposition that there was syncope.[38]

Snow continued to write on the dangers of improper administration and the toxic qualities of chloroform. As fatal cases arose, Snow collected and summarized them, and reported his own conclusions. His first comprehensive study[39] appeared in Edinburgh, the camp of his worthy opponent, Sir James Simpson. Here he again stressed the foolhardiness of administering chloroform by the Simpson technique. He attributed the numerous deaths that were arising in part to the use of this technique, and in part to the cumulative effect of the large doses that were still being used. He said the best treatment for an overdose of chloroform was artificial respiration, carefully performed.

In still another study Snow[40] outlined his theories as to the causes of chloroform death. He based his conclusions on the many experiments he had performed on animals. He found that when a certain quantity of chloroform was present in the blood, sensibility was so far diminished that surgical operations could be performed without pain. The addition of more chloroform had the effect of diminishing sensibility to such an extent that the necessity of breathing was no longer felt; respiratory movements therefore ceased and the result was an arrest of the circulation of the

[38] John Snow, "The Fatal Chloroform Case at Newcastle," *ibid.* 1. 239.

[39] John Snow, "On Fatal Cases of Inhalation of Chloroform," *Edinb. Med. Surg. Jour.* 72 (1849) 75–87.

[40] John Snow, "On the Cause and Prevention of Death from Chloroform," *Lond. Jour. Med.* 4 (1852) 320; 415; 564.

blood. He also found, in some of his experiments, that if sufficient chloroform was absorbed, the action of the heart could be arrested by chloroform alone.

When animals such as dogs, cats, rabbits and guinea pigs were made to respire air containing from 3 to 5 per cent of chloroform until breathing ceased, Snow found that the heart continued its action for about a minute. On the contrary, when the same kind of animals were forced to respire air charged with as much as 8 per cent of chloroform, death occurred with great rapidity, and the action of the heart ceased about the same time that breathing ceased, and in some instances before the cessation of breathing. John Snow, working with very limited equipment, reached the correct conclusion that although respiration usually ceases before the heart ceases to function, sometimes the heart is the first to stop. In his ether experiments, however, Snow found that the heart continued to beat after breathing had ceased. He proved that even when 50 per cent of the volume of air was ether vapor, it was not more rapid or powerful than the vapor of chloroform when this vapor constituted only 5 per cent of the inspired air. Consequently, ether was much safer as an anesthetic than chloroform.

Snow therefore concluded that deaths from chloroform arose from an overdose of chloroform. The sudden manner in which the alarming symptoms came on showed that they were produced by the respiration of air containing not less than 8 per cent of chloroform vapor. From the history of the cases he thought it probable that the heart was disabled, in most instances, by the direct action of chloroform.

The life work of John Snow was embodied in his magnificent monograph, *On Chloroform and Other Anaesthetics: Their Action and Administration*, published shortly after his death (Fig. 4). Indeed, during the last few years of his life, according to Richardson, he had forebodings that his life would not be long, and he therefore put in what time he could in the preparation of this work. On June 10, 1858, he suffered a slight stroke. He recovered sufficiently to pen a portion of his book. In fact, he had written almost to the end when he must have suffered another cerebral accident, for his housekeeper found him on the floor. He had lost all power over his left arm and leg, and his mouth appeared drawn to the right side. Memory and consciousness were unimpaired until almost the end, which occurred on June 11.

The medical profession is greatly indebted to Benjamin Ward Richardson, Snow's friend of long standing and a fellow anesthetist, not only for his intimate biographic account of Snow but also for his editing and prepa-

ration of the manuscript for the press after Snow's death. Although Snow was preceded by Flagg of Philadelphia who wrote on anesthesia in 1851,[41] Snow's monograph is rightly referred to as the first textbook in this field. It incorporates not only chloroform but all other anesthetic agents from the discovery of anesthesia until the time of Snow's death. It is not merely a descriptive work; it makes application of scientific methods of observation and experimentation, and is a basic book even today, containing important facts about the pharmacology and physiology of this important branch of medical science.

Most of the contributions of John Snow to anesthesiology have been reviewed in the preceding pages of this study and from Snow's original papers for the most part, in order that a chronologic development might be given. In Snow's book they are again repeated, sometimes in greater detail. More than one hundred pages are devoted to the cases in which the administration of chloroform was fatal. These include fifty cases which Snow had combed from the literature. Thirty-five of these cases were accompanied by necropsy reports, and strengthened Snow's convictions about the causes of chloroform deaths.

Snow, as has been intimated earlier in this paper, was in quest of a perfect anesthetic, as several anesthetists have been in the past and more are at present. His aim was to discover an agent that might be inhaled with perfect safety and which would annul common sensation without abolishing consciousness. In his studies on narcotism he considered several possibilities. These included, besides ether and chloroform, nitric ether, bisulphuret of carbon, benzin, bromoform, Dutch liquid (hydrochlorate of chloride of acetyl), bromide of ethyl, iodide of ethyl, nitrate of oxide of methyl, acetone, pyroxylic spirit and alcohol. Later, he experimented with amylene and the monochloruretted chloride of ethyl.[42]

Of all the substances he tried, amylene seemed to come closest to his ideal. In his monograph Snow went into considerable detail concerning its possibilities. Although amylene had been described in 1844 by Balard[43] of Paris, Snow did not find out about it until 1856. He immediately started to investigate its narcotic properties. After performing fifty-three experiments on animals, he concluded that a mixture of 10 per cent of the vapor of amylene with air made the animals lose consciousness, a mixture of 20 per cent of the vapor caused a deep state of insensibility and a mixture of

[41] J. F. B. Flagg, *Ether and Chloroform; Their Employment in Surgery, Dentistry, Midwifery, Therapeutics, etc.* (Philadelphia 1851).

[42] Snow's spelling has been maintained throughout the paper.

[43] Balard, "Amylene," *Ann. Chim.* (*Phys.*) Series 3, 12. 320. Cited by Snow, *op. cit.* (see note 7).

25 per cent of the vapor could be breathed with perfect safety. Whereas chloroform, used in twice (10 per cent) its proper strength, is capable of causing sudden death, a lethal dose of amylene was found to be nearly 40 per cent, or more than twice its proper strength. It seemed to Snow, therefore, that amylene might be a satisfactory agent.

After his experimental studies, Snow first administered amylene clinically in King's College Hospital on November 10, 1856. The patients were two boys about fourteen years of age who had a few of their teeth extracted. He used only a few drams of amylene. Consciousness was not abolished in either case; neither was pain altogether prevented. The effects were considered favorable, however, and another trial of the agent was made in King's Hospital on December 4, 1856. On this occasion Snow administered amylene to four patients for the extraction of teeth. This time the results were perfectly satisfactory. On December 11 and on December 13, Snow employed amylene again in several cases of exodontia, with favorable results. Later amylene was used in more serious operations such as removal of a fungus from a testicle, excision of diseased glands of the groin, and in two cases of tenotomy. Encouraged by these results, Snow used amylene in 238 cases from November 1856 to July 1857. However, in two cases the patients died from the effects of the anesthetic agent. One case involved an operation for fistula-in-ano and the other involved removal of a small epithelial tumor from the back.

Snow felt that in each of these cases the patients must have taken into their lungs air containing upward of 30 per cent of amylene vapor. He felt the cause of the difficulty to be the unsteady boiling point of amylene. He found that the boiling point of the agent varied between 86° and 115° F. If amylene had had a constant boiling point, he felt, his expectations of satisfactory anesthetic agent might have been fulfilled. Because of the unfavorable outcome in these two cases, he discontinued the use of this anesthetic.

In conclusion, it is apparent that modern anesthesia owes a great debt to John Snow. He was not only an indefatigable worker, but was a scientist of no mean ability and a great searcher for the ultimate truths. May present and future anesthetists be inspired by his work in their aim to make their work of continual profit to mankind.

The History of Anesthesia and Analgesia in Obstetrics

CLAUDE EDWIN HEATON*

BENJAMIN RUSH once expressed the hope that a medicine would be discovered which "should suspend sensibility altogether and leave irritability or the powers of motion unimpaired and thereby destroy labor-pains altogether."[1] After almost a century the ideal agent for the relief of pain in childbirth has not been found. Furthermore, the advisability of complete analgesia and amnesia during labor has been seriously questioned. The spate of literature advocating the employment of the greatest variety of drugs and techniques in relieving the pain of childbirth, is in itself an indication that no one method has been found that is entirely efficacious and safe for mother and child.

For centuries prior to the era of modern anesthesia attempts were made to relieve the suffering of childbirth. From the very first such efforts met with severe opposition. In 1591, Eufame MacAlyane of Edinburgh was buried alive on Castle Hill for seeking the assistance of Agnes Sampson for the relief of pain at the birth of her two sons. Wecker cites a prescription for painless delivery dated 1660 from the *Eighteen Books of the Secrets of Art and Nature.*[2]

Zerobabel Endecott of Salem, Massachusetts, in 1677, gave the following receipt 'For Sharpe & Dificult Trauel in Women with Child."

> Take a Lock of Vergins haire on any Part of ye head, of half the Age of ye Woman in trauill. Cut it very smale to fine Pouder then take 12 Ants Eggs dried in an ouen after ye bread is drawne or other wise make them dry & make them to pouder with the haire, giue this with a quarter of a pint of Red Cows milk or for want of it giue it in strong ale wort.[3]

In 1804, Peter Miller of Philadelphia, wrote an Inaugural Dissertation for the degree of Doctor of Medicine at the University of Pennsylvania entitled *An Essay on the Means of Lessening the Pains of Parturition.* The method advocated was copious blood letting as first proposed by Benjamin Rush. In 1806, William P. Dewees described the same method in a thesis

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[1] Benjamin Rush, *Medical Inquiries and Observations* (5th ed. Philadelphia 1818) 4. 221.

[2] E. S. Ellis, *Ancient Anodynes—Primitive Anaesthesia and Allied Conditions* (Heinemann, London 1946).

[3] Zerobabel Endecott, *Synopsis Medicinae* (The Essex Tracts, No. 5, Salem 1914).

entitled *An Essay on the Means of Lessening Pain and Facilitating Certain Cases of Difficult Parturition.* A second enlarged edition of this work appeared in 1819.

To Sir James Y. Simpson belongs the credit for the introduction of modern anesthesia in obstetrical practice. He first used ether in childbirth on January 19th, 1847. The patient's first labor had been terminated by craniotomy. At the second labor, Simpson performed internal podalic version because of an unengaged head and prolapsed cord. The child was lost but the mother suffered no pain during the delivery which took about twenty minutes. On February 3rd, Simpson administered ether in a second case, this time for a forceps delivery, with satisfactory outcome for both mother and child. On February 12th, a third case was delivered successfully, with forceps, under ether anesthesia. Simpson then reported his results on February 10th before the Obstetrical Society of Edinburgh.

Early in November, 1847, Simpson began experimenting with the assistance of Keith and Mathews Duncan in an attempt to find a better anesthetic agent than ether. On November 4th, chloroform was tried and was considered far stronger and better than ether. On November 8th, Simpson used chloroform for the first time in an obstetrical case, and by November 10th had presented a paper on the new agent at the first winter meeting of the Edinburgh Medico-Chirurgical Society. The use of anesthesia in childbirth aroused violent opposition from the clergy as well as from some members of the medical profession. Simpson vigorously defended his position against those who quoted the Bible to prove that pain was a foreordained penalty. He quoted in rebuttal *Genesis* 2:21 to show that God was the first anesthetist for he had caused a deep sleep to fall upon Adam before he removed one of his ribs.[4]

On April 19th, 1853, Simpson received a letter from Queen Victoria's obstetrician, Sir James Clark, which read in part as follows:

> I am almost forgetting to notice the chief object of my writing to you, which was to tell you that the Queen had chloroform exhibited to her during her late confinement. . . . It acted admirably. It was not at any time given so strongly as to render the Queen insensible, and an ounce of chloroform was scarcely consumed during the whole time. Her Majesty was greatly pleased with the effect and she certainly never has had a bettery recovery. . . . I know this information will please you, and I have little doubt it will lead to a more general use of chloroform in midwifery practice in this quarter than has hitherto prevailed. . . .[5]

[4] *The Obstetric Memoirs and Contributions of James Y. Simpson*, edited by W. O. Priestly and Horatio R. Storer (Philadelphia 1856) vol. 2.

[5] A. M. Claye, *The Evolution of Obstetric Analgesia* (Oxford University Press, London 1939) 15.

This use of chloroform was during the birth of the Queen's eighth child, Prince Leopold, and John Snow, the first physician to devote his full time to anesthesia, administered the drug. The popularity of chloroform in obstetrics was greatly increased.

The claim has been made that Dr. Crawford W. Long was the first physician to use anesthesia to lessen the pains of childbirth. This claim has been effectually refuted by Howard R. Raper and need no longer concern us.[6]

Considering the fact that surgical anesthesia was first used in the United States, it is surprising that there was such a long delay in its application to obstetrical practice. The first recorded case of the use of ether in childbirth in this country is to be found in a letter from Nathan Colley Keep in the *Boston Medical and Surgical Journal* for April 14th, 1847, entitled "The Letheon administered in a case of labor." The letter reads as follows:

Dear Sir:—On the 7th instant I administered the vapor of ether in a case of natural labor. The patient was in good health and in labor with her third child. Five and a half hours having elapsed from the commencement of labor, her pains, which had been light but regular, becoming more severe, the vapor of ether was inhaled by the nose and exhaled by the mouth. The patient had no difficulty in taking the vapor in this manner from the reservoir without any valvular apparatus. In the course of twenty minutes four pains had occurred without suffering, the vapor of ether being administered between each pain. Conciousness was unimpaired and labor not retarded. Inhalation was then suspended that a comparison might be made between the effective force of the throes with and without the vapor of ether. No material difference was detected, but the distress of the patient was great. Inhalation was resumed, but the progress of the labor was so rapid that time could not be found for sufficient inhalation to bring the system perfectly under its influence; still, the sufferings of the last moments were greatly mitigated. From the commencement of the inhalations to the close of labor, thirty minutes; number of inhalations, five. No unpleasant symptoms occurred, and the result was highly satisfactory.

Yours, etc.,
N. C. KEEP

Boston, April 10, 1847.

Walter Channing, Professor of Obstetrics at the Harvard Medical School, was the principal American champion of the use of ether in childbirth. Soon after Morton's demonstration of ether as an anesthetic agent, he began to use it in his obstetrical practice. In the *Boston Medical and Surgical Journal* for 1847, he reported "A Case of Inhalation of Ether in Instru-

[6] H. R. Raper, "A Review of the Crawford W. Long Centennial Anniversary Celebrations," *Bull. Hist. Med.* 13 (1943) 340.

mental Labor." This was a case of prolonged labor in a primipara, terminated by craniotomy, after attempted forceps. On May 15th, 1847, he delivered another primipara, successfully, with forceps, while using ether. These two cases were reported in a pamphlet issued in May, the first independent publication on the subject in the United States. A second enlarged edition was issued in July, 1847.

In the autumn of 1848, Channing's classic book appeared: *A Treatise on Etherization in Childbirth. Illustrated by Five Hundred Eighty-one Cases.* The author defines the keynote of his work as follows:

> My object was to learn if this use of it had been safe—safe both to *mother* and to *child*, and thus, as far as such results might reach, to contribute something towards settling the most important point concerning its further use, namely, that of its safety.

Channing says of his book "it treats of a noble subject—the *remedy of pain*." In an appendix to the volume some twenty physicians in and around Boston gave their experiences in support of Channing's position. Among those reporting the largest number of cases of the use of anesthesia in natural labor prior to the middle of 1848 were John Bigelow, 10 cases; A. R. Thompson, 15 cases; John Homans, 56 cases; Simon Packer, 22 cases; John Jeffries, 10 cases; and A. Phelps, 27 cases.

Augustus Kinsley Gardner of New York City was the first to use chloroform in obstetrics in this country. He administered the drug in a normal delivery on February 2, 1848.[7]

At the second annual meeting of the American Medical Association held at Boston in 1849, the report of the Committee on Obstetrics was presented and read by the acting Chairman C. R. Gilman of New York. The report dealt chiefly with the consideration of anesthetics and their application in obstetric practice. It stated that the use of these agents "was not only justifiable for the purpose of alleviating the pain of labor, but also that, in all *difficult* and *instrumental labors*, their application *could not be rightfully withheld*." Preference was given to chloroform over all the other anesthetic agents.

Fordyce Barker and George Elliot were important champions in New York of the use of anesthesia in childbirth. Elliot wrote, "I would not practice medicine another day if I did not possess the power of relieving pain." In the West, Henry Miller of Louisville, the first to administer chloroform in labor west of the Alleghenies, and Marmaduke B. Wright

[7] *Bull. N. Y. Acad. Med.* 1 (1862) 309.

of Cincinnati, defended the new procedure. In opposition were arrayed three of the leading teachers of obstetrics in the United States, Meigs, Hodges, and Bedford. Meigs wrote:

> I sincerely regret the introduction of anesthesia into midwifery; not because they are not useful and laudable in some rare cases, but from a conviction that the use of them has become a great abuse, which I believe will become greater until the day—no distant one—shall arrive, when mankind and the profession also, shall have been convinced that the doctors have made a mistake on this point, in this part of the nineteenth century. . . . I am still quite convinced that the discovery of anesthesia in midwifery has done more harm than good, and I believe its use will decline, and not increase.[8]

In 1863, Horatio R. Storer of Boston wrote an excellent defense of the use of anesthesia in obstetrics in a pamphlet entitled *Eutokia: A Word to Physicians and to Women upon the Employment of Anesthetics in Childbirth*

For many years ether and chloroform were the sole anesthetic agents used in obstetrics. Then nitrous oxide was introduced by Klikowitsch of Petrograd in 1880 and Winckel of Dresden in 1881. In 1909, J. Clarence Webster of Chicago began to use nitrous oxide and oxygen in obstetric practice in this country.

Following the gradual acceptance of anesthesia to relieve pain during the second stage of labor, trial was made of agents to produce amnesia and analgesia during the first stage of labor. The first agents used were scopolamine hydrobromide and morphine sulfate, introduced by von Steinbüchel of Graz in 1902. C. J. Gauss of Freiburg did much to popularize the new method, reporting his experience with five hundred cases in 1906. In this country W. H. Knipe of New York was a pioneer in the use of twilight sleep as the method was called. Many American obstetricians visited the clinic at Freiburg to observe the technique at first hand. In 1914, wide publicity given to twilight sleep led to its abuse in unskilled hands. A high incidence of asphyxiated babies led to the abandonment of the method as originally used.[9]

The furor over twilight sleep was followed by "the battle of the barbiturates." The barbiturates were introduced in medicine in 1903 but were not used in obstetrics until about 1928. Their use by the intravenous route was soon given up as unsafe but they are still widely used, administered by mouth.

In the last twenty-five years numerous agents and methods have been

[8] C. D. Meigs, "On the Use of Anesthesia in Midwifery," *Med. Exam. Rec. of Medical Sciences*, n.s. 4 (Philadelphia 1848) 145–53.

[9] C. J. Gauss, "Geburten im künstlichen Dämmerschlaf," *Arch. f. Gynäk* 78 (1906) 579–631.

introduced in an attempt to achieve painless childbirth. Fielding H. Garrison wrote of the casuistry with reference to the numerous methods available.[10] Among these may be mentioned Gwathmey's synergistic analgesia (1923–1924) in which the synergistic effects of morphine and magnesium sulfate used hypodermically are combined with the rectal installation of ether. Without question the safest method of anesthesia available is direct local infiltration as advocated in this country by George Gellhorn, Joseph B. De Lee, Alfred C. Beck, and others. Spinal, paravertebral, peridural, and sacral anesthesia all have their advocates.[11]

The wisdom of the attempts to totally relieve the pains of labor has been seriously questioned by many earnest students of the subject. De Lee has repeatedly pointed out the price we pay in our attempts to make childbirth painless. Perhaps as the psychiatrists have suggested the inordinate demand for painless childbirth is symptomatic of the anxiety and insecurity existing among certain groups in our culture today. It is questionable from a psychologic standpoint whether the passive role assigned to women in painless childbirth is a desirable one. Grantly Read of London has pointed out the significance of the emotional factors in childbirth and has shown that in the absence of tension there is no pain in labor.[12] It is not the province of the historian to guess at developments to come, but to leave the record of them to some future devout follower of Clio.

[10] F. H. Garrison, *An Introduction to the History of Medicine* (W. B. Saunders Company, Philadelphia 1929) 739.

[11] C. B. Lull and R. A. Hingson, *Control of Pain in Childbirth* (2nd ed., J. B. Lippincott Company, Philadelphia 1945).

[12] G. D. Read, *Revelation of Childbirth* (Heinemann, London 1942).

Historical Notes on the Pharmacology of Anesthesia

CHAUNCEY D. LEAKE*

THE history of special subjects tends to become stereotyped. Outstanding contributors to a special field are frequently overlooked in the first historical surveys made of the subject, with resulting and continued injustice. This tendency has been marked in the history of anesthesia, where dramatic applications of laboriously acquired information frequently overshadow the significance of the basic scientific effort.

Although pharmacology as a scientific discipline has only developed in the last hundred years, along with practical anesthesia, there had been since the beginning of civilization the sensible application to the relief of pain of various observations on the action of crude plant and mineral materials on living things. This process was indeed the beginning of medicine.

The Peruvian Incas had apparently learned that the chewing of coca leaves would numb the mouth and quiet hunger. They apparently reasoned that whatever was in the coca leaf could come out in chewing, and might be dropped on a wound to relieve pain. It has been surmised that this procedure was an effective method of anesthesia in the remarkably successful trephining undertaken by Inca medicine men.

By the time of the Roman empire, enough information had been gathered on the action of plant remedies for Dioscorides, the physician of Nero, to propose the use of mandragora, and other similar atropine-containing plants for relief of pain in surgery. The pain-relieving properties of alcohol and opium were appreciated during the Middle Ages, and various mixtures of them were used as anesthetics, to make the crude surgery of the period possible.

When that brilliant youth, Valerius Cordus (1515–1544), first prepared ether by distilling "strong biting wine" (alcohol) with the "sour oil of vitriol" (sulphuric acid), he correctly observed its leading physical properties, including its rate of evaporation, and he noted its stimulating effect on salivation. It seems that the renowned Paracelsus (1493–1541) may have known about the new chemical and its sleep producing properties. However, no applications were made of these observations until three

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centuries later. By then it was apparently common knowledge that ether would produce a delirious effect like alcohol, and it was indeed used for this purpose in the backwoods barn frolics in the United States. The observation by young Dr. Crawford W. Long of Athens, Georgia, that an individual under the influence of ether might fall without a pain reaction, suggested to him its possible use in surgical anesthesia. This was first accomplished in March, 1842.

With the development of modern chemistry under the influence of A. L. Lavoisier (1743–1794) and his quantitative studies of respiratory gases, there began semi-pharmacologic studies on such new gases as oxygen and nitrous oxide, which had been isolated by Joseph Priestley (1733–1804) in 1772. By 1800 Humphry Davy (1778–1829) had published his *Researches, Chemical and Philosophical, Chiefly Concerning Nitrous Oxide* (London 1800), in which he described the anesthetic properties of nitrous oxide and suggested its use during surgical operations. These studies had been made while Davy was Director of Experiments at Beddoes' Pneumatic Institute.

Further semi-pharmacologic studies in anesthesia were made by Henry Hill Hickman (1800–1830) when he showed that partial asphyxiation would produce unconsciousness, and that carbon dioxide would also produce unconsciousness and relief from pain. His "Letter on Suspended Animation" (Ironbridge 1824) was published without arousing interest.

The exhilarating effects of nitrous oxide, which had been noted by Davy, and caricatured, were used by itinerant showmen to impress rural audiences. The Hartford dentist, Horace Wells (1815–1848), noted such a performance, and observed that an individual under the influence of nitrous oxide might suffer a severe blow without evidence of pain. With the assistance of Gardner Q. Colton, the demonstrator, Wells used the gas on himself, and may have made other gross experiments with it. His failure to study nitrous oxide in a careful manner, with some effort at quantification, was probably responsible for the fiasco of his attempted demonstration of its value in surgical anesthesia at the Massachusetts General Hospital in 1844. Years later, Colton successfully established nitrous oxide as an anesthetic by giving it with enough oxygen to prevent asphyxial complications.

Wells's former dental partner, W. T. G. Morton (1819–1868), becoming impressed with Wells's effort, undertook a more systematic study of ether, which had been suggested to him by the distinguished Boston geologist and chemist, Charles T. Jackson. Morton at least learned in a

rough empirical way something of the concentration of ether vapor required to produce unconsciousness and relief from pain. He seems to have experimented with animals and also upon himself. At any rate, he was sure enough of his technique to carry through the famous demonstration on October 16, 1846 in the amphitheatre of the Massachusetts General Hospital with complete success.

Now that the practical demonstration of anesthesia had been made, systematic pharmacological studies in anesthesia began in France, to be continued in Russia and Great Britain, and then toward the close of the nineteenth century to be developed with rich enthusiasm in the United States. Early in 1847, M. J. P. Flourens (1794–1867) reported crude pharmacological studies on the anesthetic properties of chloroform in comparison with ether. Physiological studies on etherization, including absorption from such mucous membranes as the rectum, were reported by N. I. Pirogoff (1810–1881), the distinguished Russian surgeon. The Scottish obstetrician, James Young Simpson (1811–1870), made an extensive pharmacological survey of ether and chloroform, using animals and later applying his observations to humans. He observed the more rapid induction with chloroform, as compared with ether, and appreciated its greater anesthetic power. He successfully introduced the use of chloroform in obstetrical analgesia. Some of his experimental equipment is still maintained in his former home on Queen Street in Edinburgh.

By 1848 some appreciation of the relationship between chemical constitution and biological activity had developed and J. F. M. Heyfelder (1798–1869) studied ethyl chloride as an anesthetic in relation to ether and chloroform. While these early comparative studies were crude, they nevertheless gave important general information which was promptly applied clinically. Systematic pharmacological studies on anesthetic agents, more in accordance with current standards of pharmacological research, were first undertaken by John Snow (1813–1858) in London. Snow investigated the absorption and excretion of anesthetic agents, and began a study of chemically related compounds that might have anesthetic action. His attention was directed toward the hydrocarbon gases. These were more thoroughly investigated by his pupil, B. W. Richardson (1828–1896). Richardson made systematic studies of the comparative toxicities of various alcohols, ethers, and other hydrocarbon compounds. He used quantitative methods and observed in general that in this series with increase in the number of carbon atoms in a straight carbon chain, there is increase in toxicity, until physical properties change. He had already noted by 1885

the anesthetic properties of ethylene, and had observed its marked anesthetic power with low toxicity. He felt at that time that its only disadvantage was its gaseous state which made it difficult to administer. Suitable inhaling appliances for administering anesthetic gases were devised by J. T. Clover (1825–1882) in 1876.

Meanwhile, a more thorough going scientific analysis of anesthetic agents, particularly in relation to asphyxiation, was undertaken by the great French physiologist, Claude Bernard (1813–1878). Bernard proposed the first theory of the mechanism of action of anesthetic agents in incomplete reversible coagulation of protein. This theory has lately been revived by Bancroft. Bernard's analysis of asphyxial factors in anesthesia (Paris 1875) led Colton to use oxygen with success in effective nitrous oxide anesthesia. Bernard also recommended pre-anesthetic narcosis with morphine.

Meanwhile, pharmacology was developing rapidly. There had been an appreciation of the basic pharmacological problem of the dose-effect and time-concentration relationship. Emphasis had been placed upon the importance of studies on absorption and excretion of pharmacological agents. Tentative studies had begun on mechanism of action. These developments in pharmacology occurred as a result of the rapid development of chemistry in the nineteenth century.

A great advance had been made with the isolation and identification of the biologically active principles of crude drugs. In 1806, F. W. A. Sertürner (1783–1841) had isolated from opium a chemically pure, crystalline compound with uniform physical and chemical properties. Because of its sleep-producing properties, this was named morphine with reference to the Graeco-Roman deity of sleep. By 1822 the great French physiologist, F. Magendie (1783–1855) was able to propose a clinical formulary using entirely pure chemical compounds instead of crude drugs.

A. Niemann in the laboratory of the great German chemist, F. Woehler (1800–1882), had isolated cocaine from coca leaves. Sporadic pharmacologic study of this alkaloid had indicated its stimulating properties on the central nervous system. It remained, however, for a young Bohemian medical student in Vienna to realize the practical significance of cocaine. Carl Koller (1857–1943) was an intern at the Allgemeines Krankenhaus, Vienna, under Sigmund Freud (1856–1939). Freud had a patient who was addicted to morphine. On the notion that morphine is a general depressant of the central nervous system, and that cocaine stimulates the central nervous system, Freud proposed treating the morphine addiction by sub-

stituting cocaine. Freud, however, was wise enough to ask his intern, Carl Koller, to investigate further the actions of cocaine. Koller did what many others had done before, he tasted the drug. He noted that it numbed his tongue, and at once he realized that he had something that he had been looking for. Koller was interested in becoming an ophthalmologist. He wanted something that he could put into the eye which would cause relief from pain in a cataract operation. The inhalation anesthetics were unsatisfactory because the apparatus was in the way of the operator. As soon as he tasted cocaine, Koller realized that the numbing sensation was due to the blocking of sensory nerves. Experiments at once convinced him that cocaine was the agent he sought. Successfully applying his experimental work to the clinic, he found indeed that cocaine, either as crystals or in solution, would give local anesthesia for the eye operations he wished to perform. Within a few weeks after the publication of his initial report, local anesthesia with cocaine was widely used in all parts of the world.

Four years previously, in 1880, V. K. Anrep had published an exhaustive pharmacological study of cocaine, noting its numbing action on sensory nerves, but without provoking interest. Following Koller's dramatic introduction of cocaine as a local anesthetic, it was promptly recognized clinically that it had serious toxic properties. It was appreciated that the drug indeed was a dangerous addiction drug, provoking marked central stimulation. The clinical demand arose to obtain as powerful a local anesthetic agent without these undesired toxic actions. In order to meet this demand, it was necessary first to learn something about the chemical make-up of cocaine. This problem was successfully solved by the great German biochemist, R. Willstätter. With appreciation of the chemical constitution of cocaine and its similarity to atropine, it was possible to undertake slight chemical modifications in order to determine what part of the molecule is responsible for the local anesthetic action. Various chemical derivatives of cocaine, such as tropacocaine (isolated in 1891 by Giesel) and eucaine, were studied and used clinically. In 1897, H. F. W. Braun (1862–1934) showed that the toxicity of cocaine is proportional to its rate of absorption, but that its local anesthetic efficiency is inversely proportional to its rate of absorption. He proposed to add epinephrine, discovered by J. J. Abel (1857–1938), to cocaine solutions, in order to decrease the rate of absorption and thus to increase the duration of the local anesthesia, and reduce toxic effects.

Simple chemical derivatives from cocaine with local anesthetic properties were devised by E. Fourneau, who demonstrated in 1903 with sound

pharmacological studies the local anesthetic value of "stovaine," and by A. Einhorn, who developed "alypin" and "novocaine."

The latter under the public name of procaine is the least toxic and most effective local anesthetic for infiltration anesthesia. From Einhorn's work there have developed many thousands of compounds with local anesthetic properties. Further advances of biochemorphic principles has led to the synthesis of compounds combining vasoconstrictor and local anesthetic properties. The mechanism of local anesthetic activity has been investigated with evidence indicating interference with essential metabolites concerned with nerve metabolism and conduction. Competitive effects are recognized which prevent enzyme chain reactions from occurring so that the conduction phenomenon is blocked. While pharmacological studies have assisted materially in introducing new local anesthetics of low toxicity and high efficiency, such studies have not produced many improvements in technique.

Quantitative methods in studying the pharmacology of anesthetic agents were slowly developed. The general principles of Paul Ehrlich (1854–1915) in emphasizing quantitative relationships between toxicity and efficiency of action in chemotherapy, stimulated the study of similar relationships in anesthesia. For local anesthetic agents this concept was developed particularly under the influence of A. S. Loevenhart (1878–1929) in a systematic study of procaine derivatives. Following the introduction of statistical methods in quantitative pharmacology under the influence of J. W. Trevan, J. H. Burn, and J. H. Gaddum in England, and of C. I. Bliss in the United States, the pharmacological appraisal of new anesthetic agents now goes forward in a reasonably satisfactory manner. Similar quantitative methods for time-concentration relationships in inhalation anesthesia have been developed under the stimulus of analyses made by A. J. Clark (1885–1941).

Pharmacological studies reveal that whenever a local anesthetic is absorbed into the body as a whole, there is evidence of central nervous system stimulation. Acute clinical reactions from local anesthetics appear to be due to excessive nervous stimulation with resulting cardiac acceleration to the point of cardiac fibrillation. The American pharmacologists, A. L. Tatum and P. K. Knoefel, have demonstrated that such cerebral depressants as the barbitals may prevent acute local anesthetic toxicity. Using biochemorphic principles, the attempt has been made to synthesize local anesthetic agents combining the properties of barbitals and procaines.

In general anesthesia careful pharmacological studies were initiated in the early part of the twentieth century on the general metabolic effects of various anesthetic agents. Exhaustive studies had been made by the English with regard to the toxicity of chloroform in comparison with ether. These studies resulted in significantly helpful reports, but without satisfactory scientific solution of the problem. They showed in general that while ether is slower acting than chloroform, and much less powerful, it is also much safer. The toxic effects of chloroform and ethylchloride on repeated administration were investigated, particularly with respect to damage to the liver. A. G. Levy's classic *Chloroform Anesthesia* (London 1922) showed the importance of adrenin release as a factor in cardiac disturbance in anesthesia, particularly with reference to acute chloroform syncope.

Pharmacological studies in general inhalation anesthesia were greatly aided by devising precise methods of measuring the content of anesthetic agents in various body tissues. M. Nicloux (1873–) made basic contributions to our knowledge of the rates of absorption and distribution into various tissues of such anesthetics as the alcohols, ether, chloroform, nitrous-oxide, and ethyl chloride. He also initiated studies on rates of excretion or destruction of these agents. These pioneering pharmacologic investigations have been widely extended by such vigorous researchers as H. W. Haggard. Nicloux appreciated the fact that the ratio of the rate of absorption of a compound into a tissue in comparison with the rate of its destruction or elimination gives the effective concentration in that tissue at a given moment after administration. This matter has become very important in the study of industrial poisons and chemical warfare agents, as indeed in all phases of pharmacology and toxicology. It can best be studied in the case of volatile drugs.

In the United States careful study was made of the metabolic effects of the general anesthetics. The work of D. D. Van Slyke, W. D. Stadie, and Wesley Bourne demonstrated the disturbances which occur in carbohydrate and phosphorus metabolism and the significance of asphyxial factors. Yandell Henderson (1873–1940) showed the importance of carbon dioxide in inhalation anesthesia and this was studied carefully by D. E. Jackson, R. M. Waters, and Arthur Guedel. Increasing recognition of the role of oxygen in inhalation anesthesia led to broad studies on oxygen therapy and administration, and paved the way for the development of aviation physiology. Here the pioneer work of Paul Bert (1833–1886) came in to its own.

From these important studies the essentially sound physiological princi-

ple of carbon dioxide absorption in general inhalation anesthesia was devised, particularly under the stimulus of Waters and Guedel. Waters and myself demonstrated again the anesthetic properties of carbon dioxide which had been shown by Hickman a century before. So far it has been impossible to apply this knowledge of carbon dioxide clinically.

G. W. Crile (1864–1943) was impressed by the significance of anesthesia in relation to surgical shock. Without satisfactory pharmacological study, but with great influence, Crile emphasized various practical factors in the use of inhalation anesthesia which produced more satisfactory results. He introduced "anoci-association" which is essentially a combination of local and general anesthesia for the purpose of reducing shock. General advance in physiological and pharmacological knowledge emphasized the importance of careful pre-operative preparation of the patient with respect to stabilization of the acid base equilibrium, the carbohydrate equilibrium, and water balance. The recognition of the extent of disturbance of carbohydrate metabolism following inhalation anesthesia resulted in the use of insulin and glucose to stop post-anesthetic nausea and vomiting.

Meanwhile, V. E. Henderson (1877–1944) and G. H. W. Lucas reopened the systematic survey of anesthetic gases. A.B. Luckhardt (1885–) and J. B. Carter accidentally rediscovered the anesthetic properties of ethylene. Further pharmacological study of unsaturated hydrocarbons led Henderson and Lucas to the discovery of the anesthetic properties of cyclopropane (1929). On biochemorphic principles the anesthetic properties of divinyl oxide were predicted before the agent was produced for pharmacological study. Such investigations revealed its anesthetic properties and resulted in its introduction for short anesthetization. John Krantz has further explored the possibility of effective non-toxic inhalation anesthetic agents among the unsaturated and unsymmetrical hydrocarbon ethers.

In an attempt to reduce the inflammability of the hydrocarbon agents, an exhaustive study was undertaken in the Pharmacology Laboratory of the University of California on halogenated hydrocarbons, which are not inflammable or explosive. This study, pursued vigorously by S. A. Peoples, P. K. Knoefel, and D. F. Marsh has resulted in nothing of practical significance as yet, but afforded a vast amount of sound quantitative pharmacological data on many new types of compounds, unfortunately not yet published in detail.

Meanwhile, the central depressant effects of the barbitals were vigor-

ously explored under excessive commercial competition. Many new types of agents were synthesized and subjected to extensive pharmacological study. The intravenous injection of such agents were found to be effective in producing anesthesia, and under the stress of war conditions, such use became very important. Sulphur derivatives of the barbitals were found to be more efficient and less toxic, and are commanding much interest at the present time.

Similarly the central depressant action of the alcohols were studied pharmacologically, with the addition of halogens, in order to obtain commercially exploitable compounds. Trichlorethanol was known as a result of research on the fate of chloral hydrate in the body. Chloral hydrate had been introduced as a central depressing sleep producing agent in 1869 by O. Liebreich (1839–1908). Pharmacological study of the halogenated alcohols resulted in the clinical introduction of "avertin" by S. Eichholtz in 1927. This preparation is 100% solution of tribromethanol in amylene hydrate. The acid decomposition of tribromethanol in the stomach prevents its oral use. Accordingly, the preparation "avertin" was devised for rectal administration.

A strong commercial factor has prevailed in the pharmacological history of anesthesia. This has been due to sharp competition between commercial concerns for the development of widely used local or general anesthetic agents. This unfortunate tendency was involved in the first demonstration of ether anesthesia, when Morton tried to hide the identity of ether under the name of "letheon," and patented it.

Fundamental problems on the mechanism of anesthesia have attracted many significant pharmacological studies. These have resulted in brilliant hypotheses, without much substantial evidence in conclusive support of any particular one. In addition to Claude Bernard's theory of reversible protein coagulation, H. H. Meyer (1853–1939) and C. E. Overton (1865–1943) emphasized the importance of lipoid solubility in the localization of the site of action of anesthetics, while R. DuBois emphasized dehydration as a factor, and H. Winterstein (1879–) showed the importance of intracellular asphyxia and interference with oxidative enzyme systems. J. Traube stressed capillary activity in anesthesia, while O. Warburg discussed the importance of absorption factors in respect to certain types of compounds, and R. Höber and R. Lillie demonstrated the significance of surface tension and membrane permeability with regard to anesthetic phenomenon. However, as V. E. Henderson concludes (*Physiol. Rev.*, 19 [1930] 171) we do not yet know how to explain anesthesia.

In spite of all the extensive pharmacological study on anesthesia, we do not yet have sufficient data for a comprehensive explanation of how anesthetics act. We do not yet know how it is that we are able to relieve pain, since we do not yet know what pain is.

In appraising progress it is frequently interesting to compare monographs on the same subject which have been written at different dates. For example, R. J. Behan's *Pain* (New York and London 1914) may very profitably be compared with the symposium entitled *Pain* published by the Association for Research in Nervous and Mental Diseases (Baltimore 1943). One of the best historical sources for information on anesthesia up to the date of its publication is J. T. Gwathmey and C. Baskerville's *Anesthesia* (New York and London 1914). This contained a very useful "list of anesthetics" which unfortunately was omitted from the second edition published in 1924. H. K. Beecher has prepared an informative *Physiology of Anesthesia* (Oxford Press, New York 1938). A. E. Guedel's *Inhalation Anesthesia* (New York 1937) gives the application of much significant physiological data on anesthesia. John Adriani has written an excellent volume on *The Chemistry of Anesthesia* (Springfield, Illinois 1946) and a fair summary with bibliography on *The Pharmacology of Anesthetic Drugs* (2nd ed. Springfield, Illinois 1941). John S. Lundy's *Clinical Anesthesia* (London 1942) offers a standard summary of clinical applications in anesthesia. The carefully prepared *History of Surgical Anesthesia* by Thomas E. Keys (New York 1945) contains much important information on the pharmacological history of the subject.

The Evolution of Endotracheal Anaesthesia

NOEL A. GILLESPIE*

ANDREAS VESALIUS is to be regarded as the inceptor of endotracheal anaesthesia, even though the full significance of his classical experiment did not become apparent for many years. Nearly a century before Harvey's publication of *De motu cordis*, Vesalius showed that the lethal effects of pneumothorax could be avoided if the lungs were rhythmically inflated by blowing air into the trachea by means of a reed or tube. In three dramatically apposite adjectives he succinctly described the condition which today we call "ventricular fibrillation." Since at least two excellent translations are available,[1] whereas the original description is seldom quoted and difficult of access, it seems pertinent here to reproduce the *ipsissima verba*.[2] In chapter seven of the sixth book of the *Fabrica*, he describes the consequences of pneumothorax in the living animal and points out that collapse of the lungs and death result. Towards the end of Book VII is the section of vital import to anaesthetists:

Vt uero uita animali quodammodo restituatur, foramen in asperae arteriae caudice tentandum est, cui canalis ex calamo aut arundine indetur, isque inflabitur, ut pulmo assurgat, ac ipsum animal quodammodo aerem ducat. Leui enim inflatu in uiuo hoc animali pulmo tantum quanta thoracis erat cauitas intumet, corque uires denuo assumit, et motus differentia pulchre euariat. Inflato igitur semel atque iterum pulmone, cordis motum uisu tactuque quantum lubet examinas, et arteriae magnae caudicem dorso explicatam, aut in thoracis cauitate, aut ad lumborum uertebras comprehendis, et spectas pariter, nihilque tibi manifestius occurrit, quam cordis et arteriarum pulsuum rhythmus. Quo aliquandiu obseruato, pulmo rursus inflandus est: hocque artificio, quo mihi gratius in Anatome nullum comperi, magna pulsuum differentiarum cognitio paranda. Quum enim pulmo diu flaccidus concidit, undosus, formicans, et uermicularis cordis arteriarumque pulsus motusue spectatur. Inflato autem pulmone, magnus rursus et uelox efficitur, mirasque inaequalitates proponit, et, ut semel dicam, haec administratio eiusmodi est, qua omnium optime pulsuum naturam medicinae candidatis proponere soleo.

Just over a century later, Robert Hooke repeated the experiment of Vesalius. The account is so diverting that it is worth reproducing verbatim

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[1] T. E. Keys, *The History of Surgical Anesthesia* (New York, Schuman's 1945) 63–64; B. Farrington in *Trans. Roy. Soc. South Africa* 20 (1932) 1.

[2] A. Vesalius, *De Humani Corporis Fabrica*, 1543, p. 662 (misnumbered 658).

from the second volume of the *Philosophical Transactions* of the Royal Society of London:

An Account of an Experiment made by Mr. Hook, of Preserving Animals alive by Blowing through their Lungs with Bellows.

This Noble Experiment came not to the Publishers hands, till all the preceding Particulars were already sent to the Press, and almost all Printed off, (for which cause also it could not be mentioned among the Contents): And it might have been reserved for the next opportunity, had not the considerableness thereof been a motive to hasten its publication. It shall be here annexed in the Ingenious Author his own words, as he presented it to the Royal Society, October 24, 1667 the Experiment itself having been both repeated (after a former successful trial of it, made by the same hand a good while agoe) and improved the week before, at their publick assembly. The Relation itself followes:—

I Did heretofore give this Illustrious Society an account of an Experiment I formerly tryed of keeping a Dog alive after his Thorax was all display'd by the cutting away of the Ribs and Diaphragme; and after the Pericardium of the heart also was taken off. But divers persons seeming to doubt of the certainty of the Experiment (by reason that some Tryals of this matter, made by some other hands, failed of success) I caus'd at the last Meeting the same Experiment to be shewn in the presence of this Noble Company, and that with the same success, as it has been made by me at first; the Dog being kept alive by the Reciprocal blowing up of his Lungs with Bellowes, and they suffered to subside, for the space of an hour or more, after his Thorax had been so display'd, and his Aspera Arteria cut off just below the Epigolotis, and bound upon the nose of the Bellows.

And because some Eminent Physicians had affirm'd, that the Motion of the Lungs was necessary to Life upon the account of promoting the Circulation of the Blood, and that it was conceiv'd, the Animal would immediately be suffocated as soon as the Lungs should cease to be moved, I did (the better to fortifie my own Hypothesis of this matter, and to be the better able to Judge of several others) make the following additional Experiment; viz.:

The Dog having been kept alive, (as I have now mentioned) for above an hour, in which time the Tryal hath often been repeated, in suffering the dog to fall into Convulsive motions by ceasing to blow the Bellows, and permitting the Lungs to subside and lye still, and of suddenly reviving him again by renewing the blast and consequently the motion of the Lungs: This, I say, having been done, and the Judicious Spectators fully satisfied of the reality of the former Experiment; I caused another pair of Bellows to be immediately joyn'd to the first, by a contrivance, I had prepar'd, and pricking all the outer-coat of the Lungs with the slender point of a very sharp pen-knive, this second pair of Bellows was mov'd very quick, whereby the first pair was always kept full and always blowing into the Lungs; by which means the Lungs also were always kept very full, and without any motion, there being a continual blast of Air forc'd into the Lungs by the first pair of Bellows, supplying it as fast, as it could find its way quite through the Coat of the Lungs by the small holes pricked in it, as was said before. This being continued for a pretty while, the dog, as I expected, lay still as before, his eyes being

all the time very quick, and his Heart beating very regularly: But, upon ceasing the blast and suffering the Lungs to fall and lye still, the Dog would immediately fall into Dying convulsive fits; but he as soon revived again by the renewing the fulness of his Lungs with the constant blast of fresh air.

Towards the latter part of this Experiment a piece of the Lungs was cut quite off; where t'was observable, that the Blood did freely circulate, and pass thorow the Lungs, not only when the Lungs were kept thus constantly extended, but also when they were suffered to subside and ly still. Which seem to be Arguments, that as the bare Motion of the Lungs without fresh Air contributes nothing to the life of the Animal, he being found to survive as well when they were not mov'd, as when they were; so it was not the subsiding or movelessness of the Lungs that was the immediate cause of Death, or the stopping the Circulation of the Blood through the Lungs, but the want of a sufficient supply of fresh Air.

I shall shortly further try, whether the suffering the Blood to circulate through a vessel, so as it may be openly exposed to the fresh Air, will not suffice for the life of an Animal; and make some other Experiments, which, I hope, will thoroughly discover the Genuine use of Respiration; and afterwards consider of what benefit this may be to Mandkind.[3]

About one hundred and eighty years elapsed between the performance of this experiment and the discovery of what we now know as anaesthesia. William Harvey's discovery of the circulation was published in 1628, between the time of Vesalius and that of Hooke. We know that between 1667 and 1846 artificial ventilation of the lungs was used extensively as a method of resuscitation; and the literature contains many allusions to the use of tubes placed in the trachea for this purpose. The history of methods to revive the apparently dead is a fascinating one, but I am not qualified to write it and can only hope that some historian who can spare the time necessary for an exhaustive search of the literature will some day give us an account of it. A century ago, when anaesthesia was first shown to be feasible, men were already in possession of the broad facts of the physiology of respiration, although the details have only recently been elaborated.

The acumen of John Snow is well known to historians of medicine. Many of them, however, too easily overlook the work in anaesthesia which occupied the last eleven years of his life and remember only his brilliant researches on cholera. During these eleven years Snow devoted himself almost entirely to practice as an anaesthetist, and to research into the nature of the anaesthetic state and the effects of the drugs available at that time on the functions of the body. In his works there are recorded in meticulous detail facts which were then overlooked for decades and were

[3] R. Hooke in *Phil. Trans. Roy. Soc.* 2 (1667) 539.

rediscovered many years later. In just this way he was, so far as I can discover, the first person to perform endotracheal administration of an anaesthetic agent. The patient, however, was a rabbit[4] and the vapor was administered through a cannula tied into an opening made in the trachea by tracheotomy. There is no evidence that Snow appreciated the importance of such a method of administration if applied to operations upon the head and neck. In his time the nature of the operations performed did not make the demands on the anaesthetist that are common nowadays. Even abdominal operations were rarely performed, since, until Lister's discovery of 1867 had won widespread acceptance, such interventions almost always led to death from peritonitis.

By 1869, however, operations in the course of which blood might be aspirated into the respiratory tract were sufficiently common to cause Friedrich Trendelenburg[5] to apply Snow's technique to the human being. In this case the apparatus was simple but included an innovation which has also been "rediscovered" a number of times in the intervening years: the "inflatable cuff." A thin rubber bag, provided with a tube by means of which it could be inflated with air, was fitted outside the lower part of a tracheotomy-tube. When the bag was inflated a leakproof seal was established between the tube and the wall of the trachea. A funnel covered with gauze was then attached to the tube and chloroform could be dropped on the gauze. This arrangement was probably used only in such radical operations as laryngectomy or excision of mandible or maxilla. In these the mutilation inherent in tracheotomy was of little moment.

It was William Macewen[6] of Glasgow who first used true endotracheal anaesthesia, in which, as is nowadays usual, a tube is passed into the trachea through the glottic opening. He wished to remove a malignant growth from the base of a patient's tongue, and devised this method whereby not only could a perfect airway be maintained, but also, by the judicious use of packing, the respiratory passages could be protected against the ingress of blood. He then conducted experiments on the cadaver to determine whether a tube could be inserted into the trachea by the sense of touch, and whether the oral or the nasal route suited his purpose better. He noticed and recorded the fact, later stressed by Magill, that instead of being straight, the axes of the nares inclined medially in such a way that their courses, if prolonged, would cross in the pharynx.[7] For this reason

[4] J. Snow, *On Chloroform and Other Anaesthetics* (London 1858) 117.

[5] F. Trendelenburg in *Archiv f. Klin. Chirurg.* 12 (1871) 121.

[6] W. Macewen in *Brit. Med. Jour.* 2 (1880) 122, 163.

[7] N. A. Gillespie, *Endotracheal Anaesthesia* (Univ. of Wis. Press 1941). This point is illustrated in Fig. 27 A (p. 84).

Macewen decided to use a tube of metal, and to insert it through the mouth, guiding it into the glottis by the sense of touch.

Before the operation itself he inserted the tube several times without anaesthesia, and thus satisfied himself of the practicability of tactile intubation. The patient was then anaesthetized with chloroform given by means of a funnel attached to the tube, the pharynx was packed off, and the operation was successfully completed. He later used laryngeal intubation as a therapeutic measure in two patients suffering from oedema of the glottis resulting from burns, and found it useful in both cases. Finally he tried to use endotracheal anaesthesia again in a case similar to the first. This time the patient, who had been intubated while conscious, asked that the tube be removed during the induction of anaesthesia. The request was granted and induction was begun. During it the patient developed violent excitement and died of cardiac failure before the larynx was even intubated. This tragedy apparently discouraged Macewen, for, although he refers to these cases in some of his later papers, I can find no evidence that he used the technique again.

During the last decade of the nineteenth century a number of workers began to use endotracheal anaesthesia. In 1893 Maydl[8] of Prague and Eisenmenger[9] of Vienna, both published descriptions of the tubes which they had successfully passed into the trachea, and which had served them well for the maintenance of anaesthesia during operations on the upper respiratory passages. Maydl depended on a pharyngeal pack of gauze to exclude blood and debris; Eisenmenger used an inflatable cuff similar to that of Trendelenburg. In either case the agent was supplied by means of a funnel covered with gauze. A technique almost identical with that of Eisenmenger was described by Van Stockum[10] of the Hague in 1898.

The original incentive to endotracheal methods, therefore, had been the needs of surgeons operating on the upper respiratory passages. In such cases surgeon and anaesthetist were constantly in each other's way, and this led to periodic interruptions of the administration which made anaesthesia unsatisfactory. The high incidence of pneumonia after operation in these cases was largely due to the aspiration into the respiratory tract of the blood and pus which trickled down from the site of operation. Intubation of the trachea made it possible for the anaesthetist to maintain smooth anaesthesia although placed at some distance from the surgical field. At the same time the pharynx or trachea could be "sealed off" so that

[8] K. Maydl in *Wien. Med. Woch.* 43 (1893) 57, 102.

[9] V. Eisenmenger, *ibid.* 43. 199.

[10] W. J. Van Stockum in *Nederl. Tijdschr. v. Geneesk.* 34 (1898) 179.

operative disjecta could not find their way in. Thus efficient anaesthesia as well as effective asepsis during operations on the head and neck became possible for the first time.

During the last decade of the nineteenth century, however, the interest of American surgeons in endotracheal anaesthesia was aroused by a different cause. Up to that time intrapleural operations had been impracticable because the lungs collapsed with fatal results when the pleural cavity was widely opened. It was in 1887 that O'Dwyer[11] of New York published the description of the tracheal tube for the treatment of laryngeal diphtheria which immediately attained a wide vogue. Later in 1887 Fell[12] of Buffalo combined a bellows with O'Dwyer's tube as an apparatus for artificial ventilation of the lungs in cases of poisoning by opiates. Tuffier and Hallion[13] in Paris had successfully opened the thorax in animals when the trachea was intubated and ventilation was secured by means of bellows. Matas[14] of New Orleans finally modified the apparatus of O'Dwyer and Fell by the addition of a funnel for the administration of the anaesthetic agent, and used it successfully in a human being.[15] In the course of the next fifteen years various workers tried to use the converse solution of the problem: that of a chamber in which negative pressure could be maintained. In this the patient's body was placed and the surgical team worked. This arrangement was so cumbersome and expensive that it was soon abandoned in favor of the easier expedient of endotracheal anaesthesia.

As far as one can tell from the literature none of the workers heretofore had consistently used endotracheal methods in cases in which it was advantageous: theirs was an occasional use in a specific case of especial difficulty. Franz Kuhn of Cassel was the man who began to use the method seriously and consistently. His papers on the subject, of which there are many, were published between 1900 and 1912, and in 1911 there appeared a monograph from his pen entitled *Die Perorale Intubation*,[16] which contains the sum of his work. Kuhn appreciated all the possibilities of intubation to the full, and applied the technique to all the operations in which it could be of real service. He devoted some thought to the material of which tubes should be made and finally decided in favor of metal. He fully explored the possibilities of the nasal route of intubation although he finally decided to use the oral route. Not only did he appreciate the value of intubation to

[11] J. O'Dwyer in *Medical Record* 32 (1887) 557.

[12] G. E. Fell in *Buffalo Med. and Surg. Jour.* 28 (1887) 145.

[13] T. Tuffier and R. Hallion in *Compt. Rend. Soc. Biol.* 48 (1896) 951.

[14] R. Matas in *Ann. Surg.* 29 (1899) 409; in *J.A.M.A.* 34 (1900) 1468.

[15] F. W. Parham in *Trans. South Surg. Ass.* 11 (1898) 223.

[16] F. Kuhn, *Die Perorale Intubation* (Berlin 1911).

prevent the ingress of foreign material into the trachea, but he was probably the first person to stress the importance of the tube as a means of removing secretions which had already found their way in. He seems to have been the first person to point out that intubation greatly facilitates the provision of good conditions for abdominal operations because it prevents glottic spasm and therefore ensures a patent airway. Like Macewen, he was keenly alive to the value of intubation for therapeutic purposes. Although operations on the upper respiratory passages were apparently his original source of inspiration, he was equally concerned with the problems peculiar to interventions in the pleural cavity. Considerations of space forbid a more detailed description of the work of this gifted and versatile man to whom anaesthesia owes much. A fuller discussion of his contributions to anaesthesia, together with specific references to his papers, will be found in the first chapter of my book;[17] those interested would do well to read his own monograph. If we bear in mind the undeveloped state of apparatus for the administration of anaesthetic vapors in Kuhn's time, it is probably fair to say that he thought of and practiced efficiently most of the uses of endotracheal anaesthesia which are current today.

It is well to remember that, up to this time, all endotracheal anaesthesia had been conducted by allowing the patient to breathe in both directions through a tube of a width nearly equal to that of the trachea. This is what anaesthetists, for convenience, call "inhalation endotracheal anaesthesia." The year 1907 saw the introduction of a different method by Barthélemy and Dufour of Nancy.[18] They passed a much narrower tube into the trachea of a dog, and through it they blew in air laden with anaesthetic vapor at a certain positive pressure, and allowed the returning gases to escape between the wall of the trachea and that of the tube. Since smooth anaesthesia resulted they then used the technique in a human being undergoing excision of the mandible, with success. This was the only case they reported, but the literature contains evidence that they and perhaps others adopted the method and used it fairly consistently.[19] Their contribution is important merely because it has been customary to regard Meltzer and Auer as the innovators of this method, which has become known as "endotracheal insufflation." Barthélemy and Dufour made no attempt to produce apnoea by insufflation, and were probably not aware that such a thing was possible.

[17] N. A. Gillespie, *Endotracheal Anaesthesia* (Univ. of Wis. Press 1941).

[18] Barthélemy and Dufour in *La Presse Médicale* 15 (1907) 475.

[19] T. Tuffier in *Bull. et Mém. Soc. de Chir.* 40 (1914) 557.

It was at this point that Meltzer and Auer[20] made their classical contribution on "Respiration without Respiratory Movements," which attracted so much attention that a number of authors, in the last twenty years, have assumed that the endotracheal route was first suggested in 1909! Meltzer and Auer showed that if air under some positive pressure were blown into the trachea at its bifurcation, life could be maintained in an animal whose respiratory movements had been suppressed by curare. The original experiments on animals involved tracheotomy, but soon the insertion of a tube through the larynx was substituted for it. A catheter of narrow bore was used and the air was allowed to escape between the tube and the trachea. The degree to which the lungs were kept distended obviously depended on the relation between the rate at which air entered through the catheter and the rate at which it could escape through the glottis alongside the catheter. The originators grasped the fundamental importance of the method to anaesthesia, and at once encouraged C. A. Elsberg[21] to apply it to the human subject. They carefully investigated every aspect of insufflation and published their findings. For this reason they deserve to be remembered as the pioneers of insufflation, even though other men had actually used it before them. Within a decade, thanks to the enthusiasm tempered with wisdom of its proponents, the use of this technique spread all over the world. For the time being it almost replaced the older method of "inhalation."

Hitherto tubes had been passed into the larynx by the sense of touch. Rigid tubes were made curved so as to facilitate their insertion: if the tube was made of flexible material it was usually equipped with a curved "introducer" of some rigid substance. Probably Kuhn was the only one of the earlier workers who, by long experience, could insert a tube rapidly and with certainty by such a difficult method. Although Kirstein[22] had devised primitive endoscopic instruments in 1895 they were not as yet widely used. Elsberg saw that endotracheal methods would not find wide acceptance until an easier and more certain method of introducing the tube was available. He both preached and practiced the use of Chevalier Jackson's laryngoscope[23] and recommended that intubation should be performed under vision. In 1913 Jackson wrote an article, evidently intended for anaesthetists, in which he strongly advocated laryngoscopic intuba-

[20] S. J. Meltzer and J. Auer in *Jour. Exp. Med.* 11 (1909) 622.

[21] C. A. Elsberg in *Medical Record* 77 (1910) 493.

[22] A. Kirstein in *Berl. Klin. Woch.* 32 (1895) 476. I am greatly indebted to my friend Thomas Keys for drawing my attention to Kirstein and his work.

[23] C. A. Elsberg in *N. Y. State Jour. Med.* 12 (1912) 524.

tion.[24] Probably this improvement in technique was the chief reason for the speed with which the use of endotracheal methods spread between 1910 and 1920. It may be of interest to point out that as early as 1913 Janeway[25] conceived the idea that laryngoscopy might be facilitated by the use of an instrument whose blade was curved rather than straight. At the time the suggestion seems to have fallen on deaf ears: yet in the last five years Miller,[26] Cassels,[27] Wiggin,[28] and Macintosh[29] have all advocated instruments which differ in that way from the conventional models.

The subject of our discussion offers several outstanding examples of the truth of the old saying that "there is nothing new under the sun." Janeway's curved laryngoscope and its modern successors provide one example. The inflatable cuff which Trendelenburg first used in 1869 reappears in the hands of Eisenmenger in 1893. Dorrance[30] used an identical contrivance in 1910, and in 1928 Guedel and Waters,[31] with no knowledge of the previous descriptions, reintroduced it into the armamentarium of the anaesthetist. Even the small bulb on the tube which serves inflate the cuff, and whose tension is an index of the pressure within the cuff was used by Green[32] in 1906 before it was "rediscovered" by Hewer[33] around 1938!

Insufflation necessitated more complicated machinery for the maintenance of anaesthesia than had inhalation. It was not enough merely to supply anaesthetic vapor: this had in addition to be forced into the trachea under positive pressure. It was thus a fortunate coincidence that the work of Meltzer and Auer and Elsberg took place at a time when anaesthetists were again actively interested in the elaboration of mechanical aids to their art. Since the time of Snow, Clover, Bennett, and Hewitt, men had relied mainly on the "open" methods and had paid but little attention to machinery. The versatile Kuhn, it is true, had designed and described in 1906[34] the prototype of what, in 1930, Sword[35] introduced as the "circle filter" apparatus; but because Kuhn was oblivious to the consequence of excessive "dead-space" he was never able to use the machine successfully because of the accumulation of carbon dioxide which took place. More-

[24] C. Jackson in *Surg., Gyn. and Obs.* 17 (1913) 507.
[25] H. H. Janeway in *Laryngoscope* 23 (1913) 1082.
[26] R. A. Miller in *Anaesthesiol.* 2 (1941) 317.
[27] W. H. Cassels, *ibid.* 3 (1942) 580.
[28] S. C. Wiggin, *ibid.* 5 (1944) 61.
[29] R. R. Macintosh in *Lancet* (1941, vol. 2) 914; *ibid.* (1943, vol. 1) 205.
[30] G. M. Dorrance in *Surg., Gyn. and Obs.* 11 (1910) 160.
[31] A. E. Guedel and R. M. Waters, *Curr. Res. Anes. and Analg.* 7 (1928) 238.
[32] N. W. Green in *Surg., Gyn. and Obs.* 2 (1906) 512.
[33] C. L. Hewer, *Recent Advances in Anaesthesia and Analgesia* (4th ed., London 1943) 115.
[34] F. Kuhn in *Deut. Zeit. f. Chirurg.* 81 (1906) 63.
[35] B. C. Sword in *Curr. Res. Anes. and Analg.* 9 (1930) 198.

over between 1907 and 1918 the value of nitrous oxide in capital operations, even if small quantities of ether had to be added to it, was being recognized. Since it is a gas, some form of machine facilitates its administration. The ingenuity of men such as McKesson, Gwathmey, Teter, Foregger, and Connell in this country, and of Boyle, Shipway, Magill, and Rowbotham in England was displayed as they evolved apparatus for the administration of anaesthetic vapors and gases.

It gradually became apparent that insufflation had been accorded a more enthusiastic welcome than, on more sober appraisal, its actual advantages were found to warrant. While it was possible to maintain life when the lungs were kept constantly partially distended, Meltzer and Auer had from the first insisted that periodic deflation was expedient. Thus they admitted in fact that some movement is necessary for the efficient removal of carbon dioxide; and experimental evidence has accumulated during the past thirty years to suggest that insufflation does not provide adequate exchange over a long period of time. In spite of mechanical precautions, such as the use of safety-valves on the machines, cases of surgical emphysema were noted after insufflation. These cases usually occurred if anaesthesia was allowed to become too light during the operation. In these circumstances the vocal cords closed in spasm around the catheter, the exit of the insufflated vapor was impeded, and positive pressure was brought to bear on the inner aspect of the respiratory tree. This pressure could cause alveolar rupture, and the consequent surgical emphysema, or "wind-tumor" as it was called, was a source of grave embarrassment to surgeon and anaesthetist alike. Experience also showed that Meltzer's conviction that foreign fluids could not enter the trachea during insufflation, because of the current of "expired" vapor coming out of the glottis was unduly optimistic. It appears[36] that Meltzer and Kuhn met face to face during a discussion of their rival methods which was held in Berlin in 1910. Each resolutely proclaimed the advantages of his own method and apparently declined to acknowledge those of his rival's.

Man has the strange habit of rising to his greatest stature when in the direst straits. Medical knowledge advances rapidly in time of war, and endotracheal anaesthesia has progressed more during the years of war than at any other time. The first World War saw the birth of extensive plastic reconstructions of the face: lengthy operations which made endotracheal anaesthesia essential for their effective conduct. It was the work of Magill and Rowbotham, the original anaesthetists to the pioneer plastic

[36] F. Kuhn in *Berl. Klin. Woch.* 47 (1910) 1769.

unit of Sir Harold Gillies, which from 1918 to 1930 gradually caused the eclipse of insufflation and the return of inhalation. These workers soon found that the condition of the patients was better when nitrous oxide was used, than if ether or chloroform was used alone. To insufflate nitrous oxide and oxygen at a considerable positive pressure over lengthy periods of time proved expensive, and they were familiar with the "semiclosed" technique of partial rebreathing which had by then been popularized by Gwathmey and McKesson in America and by Boyle in England. Magill and Rowbotham had also discovered that insufflation was no real guarantee against the aspiration of fluids in the pharynx, and that the double intubation necessitated by insufflation, if the pharynx was to be packed, was cumbersome and difficult to perform.[37] It was by accident that they discovered that a rubber tube of wide bore would often enter the trachea if passed through the nose and pharynx; but experience soon taught them that this new method of "blind intubation" could by practice be made consistently successful.[38] Thus they reverted to the old "inhalation" method in which respiration took place in both directions through a tube of ample width, and soon decided that this more closely resembled normal respiration than did insufflation. Gradually, during the 1920's, the technique evolved by Magill and Rowbotham at Sidcup during the war was progressively learned by anaesthetists, applied to other types of operation, and, after various misgivings and objections, accepted by surgeons as they saw for themselves the benefits which accrued to their patients.

During the same period Ralph Waters applied to clinical anaesthesia the principle of the absorption of expired carbon dioxide by chemical means which had been advocated by Snow,[39] Kuhn,[40] and Dennis Jackson.[41] When this "absorption technique" is used the flow of gases is very slow, since an excess of anaesthetic vapor need not be constantly wasted merely to act as a vehicle for the expired carbon dioxide. The method was enthusiastically acclaimed in the United States and is gradually displacing the older techniques all over the world. Since it virtually depends on respiration in both directions through a canister which contains soda-lime, the absorption technique is the antithesis of insufflation. The work of Magill and Rowbotham followed shortly by that of Waters initiated a gradual eclipse of insufflation by inhalation that has become more complete with

[37] E. S. Rowbotham in *Brit. Med. Jour.* 2 (1920) 590.

[38] I. W. Magill in *Proc. Roy. Soc. Med. (Anaes.)* 22 (1928) 83.

[39] J. Snow in *London. Med. Gaz.* 12 (1851) 622.

[40] F. Kuhn, *op. cit.*, see note 34.

[41] D. E. Jackson in *J. Lab. and Clin. Med.* 1 (1915) 1.

each passing year. In 1929 Flagg[42] introduced his flexible modification of Jackson's bronchoscope, and in a series of papers vigorously sponsored a more extensive use of endotracheal anaesthesia. Guedel and Waters[43] in 1928 revived the use of an inflatable cuff identical with the earlier models of Trendelenburg, Eisenmenger, Dorrance, and others. Interest in endotracheal anaesthesia, and particularly in "blind intubation" by the nasal route, was quickened on this continent by a visit from Magill in 1930. He read a paper in Winnipeg[44] at a professional meeting, and in it described his experiences and methods.

The rapid advances which have taken place in thoracic surgery in the last twenty years owe their very existence to the endotracheal method to whose development they have, themselves, been a major incentive. In operations upon the substance of the lung itself endotracheal anaesthesia is vitally important, not only because it provides the simplest means to control pulmonary collapse when the thorax is "all display'd," but because pus, blood, and mucus can be easily removed by suction through or alongside the tube. Magill and Hewer, in the course of many years of work at the Brompton Hospital in London, have made numerous technical contributions to our ability to provide these desiderata; and in 1932 Gale and Waters[45] described a method of "endobronchial anaesthesia" whereby anaesthesia could be maintained by means of the relatively sound lung while the lung undergoing operation remained collapsed and immobile.

The last five years of war have added nothing original of importance to our knowledge of the subject. Endotracheal anaesthesia has been widely used by the Allied armies and has been of enormous value. The more conservative feel that it has been too often used in military practice. The use of the endotracheal technique in civil practice has also been rapidly increasing. Its value has always been recognized by a few; its advantages are obvious. Its disadvantages can all be summed up by saying that if the method is to be safe, practical, and efficient it must be used by a person of established skill. This skill is the reward of great experience superimposed on a foundation of sound medical training. Where medical men devote themselves exclusively to practice as anaesthetists, there the endotracheal technique has established itself earliest and has spread farthest. The currency or otherwise of endotracheal anaesthesia is a sound index of the erudition of any city or country *in arte anaesthetica.*

[42] P. J. Flagg in *Curr. Res. Anes. and Analg.* 8 (1929) 327.

[43] A. E. Guedel and R. M. Waters, *ibid.* 7 (1928) 238.

[44] I. W. Magill, *ibid.* 10 (1931) 164.

[45] J. W. Gale and R. M. Waters, *ibid.* 11 (1932) 283.

The Development of Anesthesiology in the United States

PERSONAL OBSERVATIONS 1913–1946

RALPH M. WATERS*

THE foundation of any specialty is dependent, I suppose, first upon men, second upon publications, and third upon organizations through which men meet for mutual development by exchange of ideas. Perhaps my own personal observations covering the past thirty-three years may shed some light upon the development of the specialty of anesthesiology in this country.

In January, 1913 I began the general practice of medicine in Sioux City, Iowa. There were roughly 65,000 people in the town and 100 physicians, of whom some 95 performed surgical operations, at least occasionally. The temptation to become one of the 95 was too great for me to resist. Previous training and ability had nothing to do with qualifications. Whether one practiced surgery or not seemed rather to depend upon having the nerve to attempt it and gaining the consent of the patient. A few more or less full-time surgeons, who were looked upon as specialists, employed nurses to administer ether in the mornings at hospitals and act as office nurses in the afternoons. A majority of us, occasional "surgeons," depended upon each other to act as anesthetist as occasions demanded, or sometimes we "borrowed" the nurse technician of one of our more glamorous surgical colleagues. Under these conditions, probably three reasons contributed to my early interest in, and special attention to anesthesia. First, the results of anesthesia which I observed were variable and offered something of a challenge. Second, extra-curricular experience in the administration of anesthetics while a student in Cleveland, together with occasional opportunities to observe the use of nitrous oxide by the extremely skillful dentist, Charles K. Teter, had developed in me an unusual interest in the subject. And lastly, one of the more "surgical" surgeons returned from an eastern trip in 1913 with a nitrous oxide apparatus (the first in Sioux City) the use of which he offered to me in other cases if I would anesthetize his patients.

* Department of Anesthesia, State of Wisconsin General Hospital. This paper was read before the William Snow Miller Seminar of Medical History, Madison, Wisconsin, March 1946.

Thus, following 1913, began a period of special interest in anesthesia. A desire to study was the natural outcome of this enforced special interest, but I did not know of Hewitt's or any other textbook nor had I seen a special journal dealing with the subject.[1] It was with considerable joy, therefore, that I discovered the introductory number of the *Quarterly Supplement of Anesthesia and Analgesia* appended to the October 1914 issue of the *American Journal of Surgery* (Fig. 1). The editorial page stated that it was the official organ of the American Association of Anesthetists and that the editor was F. Hoeffer McMechan. Needless to say, this supplement to the *American Journal of Surgery* was favorite reading matter until it was discontinued in 1926. Almost simultaneously with the appearance of the quarterly supplement, the textbook of Gwathmey and Baskerville became available (Fig. 2). Gwathmey with McMechan's help had begun the organization of an American Association of Anesthetists in 1912 after a request for a section in the American Medical Association was denied. This organization held scientific meetings yearly from 1913 to 1926, under the secretaryship first of Gwathmey and then of McMechan. My name appears among those elected to membership in 1917.

Papers by Ira McKesson had earlier attracted my attention. In the fall of 1915, correspondence with him resulted in my visiting Toledo. The nitrous oxide apparatus purchased for our use by the surgeon in 1913 had seemed to me unsatisfactory. It had been replaced by one devised by Coburn of New York, and that by modifications of my own. My curiosity regarding the McKesson technique was satisfied during this visit and several pieces of apparatus from the Toledo Technical Appliance Company were used thereafter. The professional hospitality shown me by McKesson is remembered with gratitude. The apparatus used was a piece of mechanical perfection. The physiological principles underlying anesthesia which he taught at that time are in the main acceptable today. Ira McKesson *was* the Toledo Technical Appliance Company. He led the life of a multiple personality. Rarely has a physician developed a serious interest outside

[1] In the British Empire the early impetus given to the scientific study of anesthesia by John Snow had borne fruit. I later learned that an excellent textbook on anesthesia had been published in 1893 by Sir Frederic Hewitt. The second edition of this work (1901) is a scholarly treatise on the subject with due consideration given to the significance of current knowledge of physiology and pharmacology as applied to the subject. The *Proceedings of the Royal Society of Medicine* began to publish papers read in its Section on Anaesthetics in 1908. In Canada and other parts of the Empire, specialization in anesthesia was common at the beginning of this century. Howell, Bourne, Johnston, and many other Canadian anesthetists were potent influences in initiating recognition and interest in the subject in the United States.

the practice of medicine without sacrificing much of his professional standing. McKesson was first of all a capable physician. His fellow members of the Toledo Academy of Medicine without exception respected him as such. He was also an expert mechanic and designed in detail all the apparatus sold. He directed the business of his appliance company with fairness to his employees and with financial success. Among business men he was highly respected. He was a civic minded, useful citizen of Toledo—a popular member of the Chamber of Commerce. And with it all, he found time to teach neophytes such as I was in 1915, not only the technical principles of the administration of nitrous oxide, but much of physiology and the diagnosis and treatment of acute physical disorders whether or not they were the result of the administration of anesthetic drugs. Many of the ideas now current regarding the use of oxygen as a therapeutic agent were discussed in Toledo at that time. McKesson was a physician, a teacher, a mechanic, a business man, and an outstanding citizen, respected by his confreres in each field. Rarely does one man lead, with success, a life so versatile.

It was through informal visits of McKesson and W. Hamilton Long of Louisville to McMechan's home, then in Cincinnati, that the Interstate Association of Anesthetists was organized. The first meeting was held in Cincinnati in 1915. McMechan was made secretary. Although I had previously exchanged letters with him, it was with considerable surprise to me that he greeted me at this meeting, as I approached his wheelchair, with "Ralph Waters from Sioux City, Iowa. We are delighted to see you." I do not yet know who had tipped him off as to my identity. He was like that—friendly toward everyone and he never forgot a name or face.

Some knowledge of the early life of the McMechans (Fig. 3) is necessary to account for their unusual accomplishments.[2] Frank's father and his grandfather were respected physicians in Cincinnati, Ohio. He graduated from St. Xavier College with both a Bachelor's and Master's degree when he was 17. In school, he is said to have excelled in oratory, elocution, debating, dramatics, and music. His father realized that he was too young to enter medical school and approved of the three years which he spent as reporter on the *Cincinnati Post*, an early paper directed by E. W. Scripps. He entered the Medical School of the University of Cincinnati in 1900,

[2] For certain facts regarding the McMechan family the author wishes to acknowledge his indebtedness to a pamphlet entitled *Francis Hoeffer McMechan, A.B., A.M., M.D., F.I.C.A., A Brief Sketch of His Life and Work*" by Omar Ranney (Lakewood, Ohio). It was incorporated in the journal *Current Researches in Anesthesia and Analgesia* (September-October 1939).

graduating in 1903. During his newspaper and medical student days, his interest in dramatics continued. Anesthetists have been accused of having stolen one of the most promising young dramatists in the early years of this century. Amateur dramatics was the means of bringing the McMechans together. Laurette Van Varsevold was a student at a Cincinnati School of Acting and they met in the relation of director and pupil-actress. They were married after he had practiced general medicine in Cincinnati for six years, during which time his major interest was devoted to anesthesia. Eighteen months later (1911) he became badly crippled with arthritis. He attended the meeting of the American Medical Association in Minneapolis in 1912 on crutches and shortly thereafter became confined to a wheel chair or bed for the rest of his life.

At the first meeting of the Interstate Association in 1915, I remember watching his movements with considerable interest. All his joints seemed to be involved in arthritic changes. He could turn his head slightly from side to side and he was able to move his hands slightly by limited flexion at the wrists and by limited pronation and supination. Movements of the mandible separated his teeth only slightly. Pain was a constant early accompaniment of his affliction as each new joint became involved. At this meeting and for several years following he was able to manipulate a pencil, once it was placed in his hand. By very skillful use of a small, very long-handled fork and a similar spoon, he was able to bring bits of food to his lips. However as the disease progressed, all joints became completely ankylosed. Later I remember striving among other of his friends for the privilege of relieving Mrs. McMechan of the task of helping him dine when he could no longer use the long-handled utensils.

The early dramatic experience together with his natural and cultivated excellence in written expression and oratorical ability were all useful aids in promoting and organizing a new speciality. Of dramatics he once said: "This experience gave me the capacity to dramatize meetings, dinners and international congresses. One must stage them to have them a success. You have to pick the papers for one of these meetings like you do characters for a play. The same is true of speakers. You must have unity of purpose to get the message across." Certainly no one who attended a meeting planned by the McMechans between 1915 and 1930 could fail to appreciate the dramatic quality. The physical handicap of the secretary only added to the dramatic setting. At a dinner of anesthetists and their wives, with visitors from all parts of the world, the voice of the helpless toastmaster penetrated most pleasingly to the occupant of every chair. Delight-

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ANESTHESIA

BY

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WITH TWO HUNDRED AND EIGHTY-THREE ILLUSTRATIONS IN THE TEXT

NEW YORK AND LONDON
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1914

FIG. 2. Title-page of Gwathmey and Baskerville's textbook on *Anesthesia*.

ful favors and honors were presented in words that brought tears to the eyes of both the recipient and his enemies. Again at scientific meetings the summary by the secretary of a morning's symposium of papers was a work of art. In ten minutes he could present the major points made by each of six previous speakers and the discussions all wrapped in an intelligible package ready to take home.

Various experiments both in publications and organization were tried by McMechan. In 1916, the Surgery Publishing Company copyrighted the first of a series of American Yearbooks of Anesthesia and Analgesia (Fig. 4) to be edited by McMechan. The foreword states:

> While the Quarterly Supplement of Anesthesia and Analgesia of the American Journal of Surgery has provided a journalistic medium for the publication of the Transactions of various associations of anesthetists it does not lend itself to the collation of the world's ultra-scientific researches in these subjects. [Consequently this series is begun. Volume one, the foreword continues] has been compiled exclusively of exhaustive articles by prominent authorities . . . to bring a given number of subjects in anesthesia and analgesia strictly up to date. In succeeding volumes of the Yearbook, Collective Abstracts will continue the revision of these subjects as necessity arises and other subjects of equal importance and interest will be introduced and as comprehensively and exhaustively handled. The Yearbook will thus assume the form of a continuously broadened and revised encyclopedia for authoritative reference.

Judging from these expressions in the foreword the editor's plans for these yearbooks were truly ambitious. A large volume of nearly 500 pages was issued for 1915–16 and a similar second volume for 1917–18. Both are a credit to the editor and the selected authors as well. War-time editing and publishing doubtless were difficult endeavors during the first as well as the second world war. The second volume did not appear until 1920 and no further volumes exist. In the foreword to volume two dated Thanksgiving Day, 1920 appears the following:

> So far no Anesthesia Foundation has eventuated although recently some forward-looking manufacturers of anesthetics and apparatus have united to finance a National Anesthesia Research Society which, it is hoped, if it can serve its expectations, will sooner or later become a foundation.

The name "National" was soon changed to "International." A monthly "Bulletin" in Pamphlet form was issued for a time, and a monograph of 97 pages on *Nitrous Oxide-Oxygen Analgesia and Anaesthesia in Normal Labor and Operative Obstetrics* was published in 1920. For a short time the International Anesthesia Research Society employed a lay Executive Secretary, T. T. Frankenberg, who maintained a headquarters office in

Columbus, Ohio, but the arrangement proved unsatisfactory and the secretarial as well as editorial work continued to be accomplished by the McMechans. The Research Society held a first Congress of Anesthetists in 1922 and the early Bulletin was replaced by a journal. The first number of *Current Researches in Anesthesia and Analgesia* appeared in August, 1922. It continued under the editorship of McMechan until his death in 1939 and is still published by Mrs. McMechan under the editorship of Howard Dittrick.

In addition to the organization of the Interstate Association of Anesthetists (1915) McMechan's stimulus was instrumental in the initiation of other regional societies in many parts of the United States and one in Canada. The year 1926 was a memorable one both for the McMechans and for anesthesia in general. In that year the old American Association of Anesthetists became the Associated Anesthetists of the United States and Canada with the purpose of serving as a parent organization to the Interstate (its name now changed to Midwestern), the Canadian, the Pacific Coast, the Southern and the Eastern Associations. *The Quarterly Supplement* appearing with the *American Journal of Surgery* was discontinued in that year.

In the last number of the *Supplement* appeared an announcement of a proposed trip of American anesthetists to attend a meeting of the Section on Anaesthetics of the British Medical Association to be held in Nottingham, England in July. The over-all cost of the trip was expected to be $1195. Seventeen American anesthetists and their wives made this trip visiting anesthetists throughout the British Isles and some continental centers. The McMechans accompanied and directed the party. Another journey to Europe was made by the amazing couple in 1928 and one to Australia and New Zealand in 1929. The latter trip was almost too much for the physical shadow that was McMechan's body at that time. Neither his physical nor his mental vigor was regained thereafter. In contrast to former days when his charming voice held audiences spellbound, he had scarcely the strength to be heard in ordinary conversation. In spite of the added handicaps McMechan carried on until his death in 1939. Although he could not attend his Sixteenth Annual Congress of Anesthetists held in Chicago two years before his death, he knew that an honor was to be conferred upon him. The following is the letter of acceptance which he sent to be read after the presentation:

> Only such a token as one of your congress loving cups could possibly symbolize your appreciation and recognition. However, this gift of gifts is far more yours

than ours, because in everything we have tried to do for you and anesthesia, you have taken the greater part.

Your memberships are in reality Organized Anesthesia itself, and your loyalty in maintaining your memberships is what has finally created international anesthesia. The present financial stability and the promising economic future of the specialty is the result of your support in good times and bad.

Your liaison with basic science, which may be one of your proudest boasts, is the friendliness of that large group of research workers who have come to our meetings for years to find out our problems, and who have then opened the doors of their laboratories to show us the solution of our problems. May this liaison prosper for years to come in our mutual cooperation.

Clinical anesthesia is what through years of pioneering each and every one of you have made it. Now it remains for all of us to bestow the heritage we have won for ourselves, to others, knowing that they will carry on splendidly. In doing this the best interest of surgery, the patient, and the hospital will be served. Added to this there are those who must shoulder the burden of teaching and instructing each new generation of anesthetists so that the specialty may never lag in carrying out its greatest obligation.

Your journal publishes the very best of your own and others' research and clinical advances as reported at your meetings and Congresses, and stands as an assurance that you are doing more than your share to realize the world conquest of human pain.

Our part in this marvelous labor of love has been the tie that binds your efforts together for effective achievement through a cooperation that has become one of the most astounding fellowships in the allied professions and basic sciences.

Needless to say this gift of gifts will be cherished for all the years to come as the most precious souvenir of our lives and work; but never forget that in treasuring it we will also keep all of you in our heart of hearts, because it is you who have made our lives, work and friendships the greatest compensation that a kindly Providence could possibly bestow.

Emotional and brilliant, true-blue, and steadfast with a moral determination to stand for what he believed right, McMechan was utterly incapable of shilly-shallying or compromise. The recognition and advancement of anesthesia were very dear to his heart. Opposition was frequently encountered. At times he vented his wrath upon surgeons and representatives of our national medical organizations, and many of these returned the compliment, with interest. Such conflicts were unfortunate and valueless. By some they were thought to have obstructed the advancement of the cause which he sought to promote. To illustrate some of the principles held by McMechan which were once thought to be controversial, I quote from an address which he made in 1935 before a joint session of the Council on Medical Education and Hospitals of the American Medical Association with the Federation of State Medical Licensing Boards. The subject of the

discussion was, "Should The Radiologist, The Pathologist and The Anesthetist be Licensed to Practice Medicine?" McMechan was asked to give the viewpoint of anesthesia. He said in part:

> Anesthesia was the gift of pioneer doctors and dentists to suffering humanity, and every significant advance in its science and practice has been contributed by doctors, dentists and research workers of similar standing. In contrast, technicians have added nothing of any consequence. Anesthetics are among the most potent and dangerous drugs used in the practice of medicine; they penetrate to every cell and organ of the body and may cause almost instant or delayed death by their toxic effects. The dosage of general inhalation anesthetics cannot be prescribed in advance but must be determined from moment to moment during administration. The dosage of local and other anesthetics must be determined by the risk of the patient, the nature and duration of the operation to be done—certainly a challenge to the knowledge and experience of the keenest doctor. No patient should ever be given an anesthetic whose condition and risk has not been diagnosed in advance of the operation, so that every resource of medical science can be used to lessen the risk and make the recovery more assuring. Certainly in this preoperative evaluation and the selection of the safest anesthetic and best method of administration, the medical anesthetist is more in a position to act as a consultant than a technician. . . .
>
> The safety of the patient demands that the anesthetist be able to treat every complication that may arise from the anesthetic itself by the use of methods of treatment that may be indicated. The medical anesthetist can do this, the technician cannot. More recent developments have extended the field of medical anesthesia to include resuscitation, oxygen therapy and therapeutic nerve block for intractable pain, and treatment of various conditions of disease and the rehabilitation of the disabled—all fields of practice quite beyond the capacity of the technician.

The thoughts which he has so well expressed are probably held at present in theory by the medical profession throughout the world. In practice in the United States we are still far from complete acceptance of them. Whether the compromises considered expedient by many will, in the long future, prove the wiser course remains to be determined.

Last year I was asked for suggestions as to a fitting subject for a portrait which might be added to the Dean Cornwell Series, dealing with anesthesia. The following notes record my thoughts at that time, stimulated no doubt by proximity since I was traveling past the towns where the McMechans lived after 1914 and where their productive work was accomplished. As made at the time, the notes read as follows:

Today I lolled through Northern Ohio in a comfortable roomette on the New York Central's Commodore Vanderbilt. Oral examinations of the

American Board of Anesthesiology lay ahead at the Waldorf-Astoria in New York. As we sped through Avon Lake and Rocky River, the skeleton-like figure of Frank McMechan in his folding wheel chair with Laurette at his back, appeared before my thoughts. Idleness led to speculation and I found myself wondering if any other physician during the century of anesthesia gave so much—of himself, his time and his wife,—to the cause of relieving pain.

I thought of Priestley and Davy, of Vesalius and Lavoisier, of Theodoric and Sertürner and the host of others who made scattered single contributions in an unconscious effort to lay the foundation stones of a science of anesthesia. I thought of Mesmer and Braid, of Hickman and Colton, of Long and Wells and of Jackson and Morton. I thought of Simpson. And then I thought of the fertile decade contributed by John Snow. And the failure of his associate Ben Richardson to carry on in the Snow tradition of brilliant investigation and hard work although he did do his friend and us the priceless service of seeing that Snow's invaluable book was finished and printed after his death. To it he added the only biography we have of its author and at the same time one of the most beautiful and perfect tributes of one physician to another; but he lacked the originality, energy and enthusiasm to finish the work that his friend had begun. And then I thought of Boyle and Clover, of Andrews and Paul Bert, of Ombredanne and Bennet, of Trendelenburg and Stockum, of Prince and Meltzer and Auer, of Teter and Guedel and McKesson, Heidbrink, Draeger and Foregger and the many others who contributed solutions to mechanical and physiological problems of anesthesia, and then I thought of Koller and Bier, of Labat and Howard-Jones. Great as is our debt to all these and many others—I said to myself—do we not owe even more to the two who gave us our first real textbooks of anesthesia—Hewitt in Europe and Gwathmey in America.

Just then I had a glimpse of the Westlake Hotel in Rocky River where Frank McMechan spent his last days and I asked myself: What sort of a contribution *is* the most important to a specialty? In my dreaming, I saw Frank, a young doctor stricken eight years after graduation with an arthritic condition which placed him first on crutches, then in a bed or a wheel chair for the rest of his life. Never again could he hold an anesthetist's mask in his hand or stand on his feet. And yet I saw him propped up in bed dictating by the hour—letters to anesthetists all over the world—articles for journals all over the world on all the various aspects of drug administration, of the importance of teaching medical students all that was

known about anesthesia, of the advantages to be gained by interstate, national and world-wide journals, meetings and discussions. I saw McMechan in my dreaming, sitting almost motionless in his chair pleading the importance of a thorough knowledge of anesthesia to a thousand physicians in a hall in Kansas City in which one could hear a pin drop and his every word in the remotest corner of the room. I saw his wife directing two strange porters how to lift him as painlessly as possible from his wheel chair to a berth in a pullman car on the Missouri Pacific for the trip from Kansas City to Chicago. I saw not only strange porters but those who spoke no English, carrying him to and from the decks of ships in the ports of Europe and Australia, always under the watchful eye and careful direction of his wife Laurette. In these countries I have been told he, again from his wheel chair, held the attention of medical audiences while addressing them in French or German when the occasion demanded.

Every slightest detail in the arrangements for anesthetists' meetings was perfect during the years while McMechan was "Secretary-General" of both American and International societies of anesthesia. Frenchmen, Germans, Spaniards, East Indians, Chinese, visitors from all over the world came to anesthetists' meetings in this country because they knew Frank McMechan. If he did not know their language, his fluency with the language of friendship filled all the gaps.

Of the anesthetists who were living between 1912 and 1939, it is doubtful if there was a single one who did not know him personally and count the McMechans his friends. The McMechans made the get-together spirit that lives after him among the anesthetists of the world.

And so I thought—yes, textbooks are necessary, great discoveries are necessary, hard work is necessary for the development and perfection of a specialty in medicine. The author of a textbook who gathers together all that has been done makes a wonderful contribution. Without it, teaching is difficult. And yet is not the man who can bring together the knowledge of a specialty that is scattered throughout the world, promote its discussion, inspire further investigation and cement all the interested individuals together with the common bond of friendship—is not such a man the greatest benefactor to his specialty?

And so I decided to suggest to the artist, a portrait of McMechan in his wheelchair, his wife a little back and to the side. Pictures seen dimly on the wall behind (or shadowy figures) representing Davy, Wells, Morton, Long, and Snow. Grouped at either side of the chair there might be room for figures representing a contemporary anesthetist of this and other

countries, and a physiologist and pharmacologist. I wondered if such a concept, translated from my crude expression to artistic terminology might appeal to Mr. Cornwell as fitting subject matter to constitute "a portrait of Anesthesia"?

Be that as it may, there is little doubt in my own mind that the contributions toward the abolition of pain in the world made by the McMechans from 1912 to 1930 were unequaled. Until 1930 we who are now considered "older anesthetists" were content to delegate all the labor of organization and the conduct of organized effort to one man. The need for a Section of Anesthesia in the American Medical Association, for a National Board of Certification, for a modernized journal of anesthesiology and other advances was evident to those within and outside the specialty. Effort was required which could not be met by older methods. The original Long Island Society of Anesthetists (1905) had been renamed the New York Society in 1911 but it had been largely a local organization. In casting about for a vehicle through which to apply newer methods, this old New York Society was expanded to become The American Society of Anesthesiologists, Inc. Some fears were felt during the decade before 1940 that this organization too might make the mistake of laziness among its individual members—of saddling one man with all the work. Through the tremendous interest, enthusiasm and energy of Dr. Paul Wood, the reorganization and expansion was launched with a minimum of difficulties. Through his unusual farsightedness and unselfishness, the constitution and by-laws provide the machinery whereby every member may do his part and help to carry the load. A Section on Anesthesiology is now included in the scientific sessions of the American Medical Association. A National Board of Anesthesiology, Inc. stands ready to certify as competent those anesthetists who pass its examinations. A creditable journal, *Anesthesiology*, is published six times a year by the American Society of Anesthesiologists, Inc. All the society's affairs are initiated through the action of a representative Board of Directors—it is a democratic organization.

There is argument throughout the world in these days as to whether a completely democratic organization can properly govern a state. Experience in societies of anesthetists testifies to certain advantages and certain disadvantages of one man direction. Initiation of the organized movement for better anesthesia certainly benefited immeasurably by the unusual personality of McMechan, by his capacity for friendship, by his untiring

labor, and by his ability to dramatize the need. Paul Wood has made a similar and no less valuable contribution to anesthesia in America.

At present a world-wide interest in the subject seems to stem from teaching organizations and publications largely in the British Empire and the United States. The responsibility upon those within the specialty is great. In years to come the application of current scientific knowledge and technical skills can carry forward the ideas, ideals, and efforts of Snow and Hewitt, of Gwathmey and McMechan. The rational control of pain can become safe and available to all the human race. To accomplish this, the specialty needs the understanding cooperation of the medical profession, of scientists, of philanthropists, of sociologists, of hospital management, and of the public.

FIG. 3. Dr. and Mrs. F. Hoeffer McMechan. (Courtesy of Mrs. McMechan.)

The AMERICAN YEAR-BOOK of ANESTHESIA & ANALGESIA

F. H. McMECHAN, A.M., M.D.
Editor

1915 1915

SURGERY PUBLISHING COMPANY
92 WILLIAM STREET ■ ■ ■ ■ ■ ■ ■ ■ ■ NEW YORK CITY.

FIG. 4. Title-page of the first volume of *The American Year-Book of Anesthesia and Analgesia.*

The Introduction of Surgical Anesthesia in France

RAYMOND NEVEU*

THE news of Warren's first successful operation with ether at the Massachusetts General Hospital spread rapidly over Europe. In France, Jobert de Lamballe, surgeon of the Hôpital Saint-Louis, was the first to attempt to obtain general anesthesia by means of ether. On December 22, 1846, assisted by a young American doctor, he applied etherization to a patient but without success; two days later, however, he achieved complete anesthesia with ether.

Malgaigne, a surgeon at the same hospital, also anesthetized his patients with ether, and on January 12, 1847 reported his observations to the Académie Royale de Médecine. He had performed five successful operations. Although he did not have the American inhalator, Malgaigne used a simple tube containing ether; he introduced this into one of the nostrils of the patient while blocking the other. The patient was ordered to inhale with the mouth closed and to exhale with the mouth open.

On January 18, Velpeau, the brilliant surgeon, read his first report to the Académie des Sciences. Here his reservations on the lasting use of anesthesia reflected somewhat the statement he had made in 1839 in his book *Les elémens de médecine opératoire:* "The prevention of pain in operations is a chimera which we in our day may not pursue." But the method of applying ether rapidly improved, the inhalators were perfected (thanks chiefly to Charrière), and on February 1st Velpeau read a second, very enthusiastic, report on the admirable results obtained with etherization.

Velpeau gave detailed descriptions of the operations in which he had used etherization, and he faithfully recorded the patients' reactions to the anesthetic. He also successfully used etherization to reduce fractures and dislocations. His report is a great monument in the history of the introduction of anesthesia in France. It closed with the greatest praise that could be given to the American discovery:

> It is obvious! It is impossible to doubt that the question of ether inhalation will assume unforeseen dimensions. . . . It is no longer possible to estimate its importance, which is of such a nature that it will impress and profoundly affect not only

* Société Française d'Histoire de Médecine. Translated from the French and edited by Miriam Drabkin.

surgery, but also physiology, chemistry, and even psychology. . . . There is no surgical operation of any magnitude which has not profited from the blessings of this magnificent discovery. . . .

From my careful observation of the facts, I must conclude that ether inhalation will become the source of innumerable unexpected applications and extensions, a mine of riches on which all the branches of medicine will be quick to draw. It will become the point of departure of so many worthy ideas, from whatever viewpoint they may be considered, that I must this very moment call on the Académie des Sciences to ask if the author of this remarkable discovery should not himself soon be the object of some notice by the Learned Societies!

The day after this memorable meeting of the Académie des Sciences, the use of ether was introduced in all surgical services in Paris and the provinces.

Inhalators were then improved and, as Louis Figuier said, "a real fever of research and publication took hold of the medical world." Perusal of the scientific journals of the time shows with what zeal and ingenuity physicians and manufacturers competed to contrive and improve all kinds of appliances.

For example, Cloquet presented an appliance with double valve, which had been invented by Amussat. Guillou produced an improved form of an appliance contrived by Luer; it consisted of a 12 cm. flexible tube to which a cork mouthpiece with double valve could be fitted. On January 4, 1847, Mathieu, and at about the same time Oudet, deposited with the Académie another valve appliance.

Charrière's name in particular is connected with the construction and development of the most delicate appliances. For example, he originated an appliance consisting of a silken receptacle held up by a spiral spring. The mouthpiece, of silver, was flexible and could be fitted exactly to any face. The lower part admitted a cloth or a sponge on which the liquid anesthetic was to be poured. Another appliance, devised by Delabarre and constructed by Charrière, made it possible to keep the mouth open while the anesthetic was being administered. French manufacturers of surgical instruments continued to improve the appliances and to make them real marvels of precision.

Among the first surgeons to popularize the American method were Roux, Laugier, and Cloquet.

On February 23, 1847, Dubois gave his report on the use of ether inhalation in midwifery, and Bonnet, Bouchacourt in Lyons, Simonin in Nancy, Sédillot in Strasbourg, and Bouisson in Montpellier, soon intro-

duced general anesthesia in their practice. It had become a regular part of surgical practice.

There was a chorus of praise everywhere. Only Magendie and Lallemand expressed any objections and protested, in the name of ethics and public security, against imprudent experiments. They held that "pain was not without usefulness in surgical operations." But their objections were disregarded.

The sad news of the dramatic death of Horace Wells reached Europe just when Jackson received the great Montyon prize from the Institut de France.

It may be said without exaggeration that the surgeons of France contributed greatly to the improvement of anesthetic methods. The physiologists studied the problem thoroughly. First Gerdy presented to the Académie the observations he had made on himself. Then Longet published his remarkable work on the effects of ether vapors on the cerebrospinal and ganglionic nervous systems—a real marvel of observation! Then came Flourens with his authoritative work on the spinal cord. On February 22, 1847 he demonstrated at the Académie des Sciences that nitrous, acetic, and oxalic ethers had the same properties.

A few days later, on March 1st, Louis Figuier, who was not only a great popularizer, but also a real scholar, presented to the Académie de Montpellier the results of his research on the action of acetic ether on animals. He declared that none of the new chemical anesthetics could replace ether for surgical purposes.

In 1831 Soubeiran had discovered a new product obtained from the distillation of alcohol and chloride of lime. This substance, studied by Liebig and Dumas, was chloroform. Flourens tried it at once on animals and reported his successful results in a paper to the Académie des Sciences.[1] Since Flourens had studied only the physiological aspects of the problem and also discussed other compounds, his article did not attract the attention of surgeons.

On November 10, 1847, Simpson's publication of 50 cases reached France; then there was great enthusiasm in the medical world for the drug. It seemed that henceforth anesthesia by ether would forever be replaced by chloroform anesthesia. However Flourens, whose moderation and wisdom were proverbial, did not hesitate to let fall from the height of the tribune of the Académie these prophetic words: "If sulphuric ether

[1] *Compte-Rendu de l'Académie des Sciences* 24 (1847) 342.

is a marvellous and terrible agent, chloroform is more marvellous and more terrible!"

Prophetic words, indeed, since disenchantment was soon to come. On July 4, 1848, Gorre reported to the Académie de Médecine the death of a young woman of Boulogne-sur-Mer as a result of anesthesia with chloroform. The death created a great sensation; judicial action was begun and the Minister of Justice asked the Académie for its opinion.

Malgaigne made the report. The report was favorable and chloroform "remained the victor in the controversy." Malgaigne concluded: "It is an admirable anesthetic agent, but it must be used only by experienced persons and never entrusted to careless or untried hands."[2]

By 1853 numerous fatal accidents from chloroform anesthesia were reported. In the next four years eighty such deaths were observed and the vogue of chloroform decreased rapidly; ether, which had been quite abandoned, gained new favor and daily had more adherents.

In 1859, the Société de Médecine de Lyon, in its meeting of March 28, unanimously adopted the following motion:

1. Ether is less dangerous than chloroform for surgical anesthesia.

2. Anesthesia obtained by ether is as lasting and complete as anesthesia obtained by chloroform.

3. The disadvantages of ether as opposed to chloroform are of little importance and do not make up for the inherent danger in the use of chloroform.

4. Therefore, ether should be used instead of chloroform.

Little by little, however, as the techniques were perfected and a purer chloroform offering complete safety was obtained, the surgeons used it more often. And it was correctly written of it: "The two anesthetic methods were henceforth completely a part of surgical practice, never again to leave."

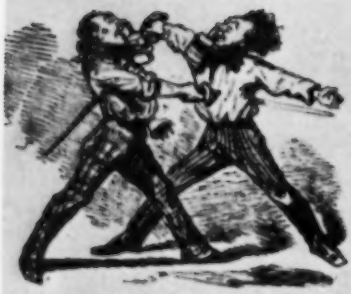
We know now what great use is made of these two marvellous anesthetics, what invaluable service they render. Thanks to them surgery has become more fearless and more efficient, and we must pay honor to those physicians who, a hundred years ago, were the pioneers in surgical anesthesia.

They were the benefactors of humanity!

[2]Académie de Médecine, Session of October 31, 1848.

ÉTUDES MÉDICALES SUR L'ÉTHER

PAR CHAM.



Une affaire d'honneur en 1847.

Abolition des peines corporelles.

Fâcheux emploi de l'éther.

Grand en essaiera des bottes neuves.

Un rêve chez le dentiste.

Inconvénient de tomber sur un opérateur qui travaille avec

La jambe de bois vient en dormant.

L'éther sera vivement apprécié en Turquie.

Nouvel intermède pour les fêtes nationales

The Reception of Ether Anesthesia by a French Cartoonist

R. L. MAYER*

THE adjoining illustration on the use of ether was published just a hundred years ago and we believe it of interest to show a contemporary lay response to an important medical discovery. None of the uses anticipated by Cham was ever actually adopted.

This cartoon appeared in the French satiric journal, *Charivari*. The merit of having created journals such as *Charivari* belongs to Charles Philipon. He founded the famous Aubert publishing house, where he first published *La Caricature* and when its frankness became too much for the authorities, *Le Charivari* (1832). Finally, he issued *Le Journal pour Rire*, the chief publication to contain the new woodcuts of artists such as Cham, Grandville, Daumier, and Gavarni.

After Napoleon III took over the government in 1852, a reorganization and an almost apolitical evolution became necessary. Cham, the author of the accompanying illustration, then became one of the best known collaborators. Cham's political cartoons were not very profound, but what was even more important, he was the originator of those small pictures and cartoons of a non-political character which reviewed various phases of middle-class life. Cham was uncommonly talented, and learned a good deal from the techniques of Daumier and Gavarni. He depicted with great success all eccentricities of the moment.

Cham's real name was Amédée de Noë. Being the fifth son of de Noë, a peer of France, he named himself Cham. He was born in Paris in 1819 and became a pupil of P. Delaroche and later on of Charlet. He was attracted especially by the small things of life.

"Charivari" originally meant a great noise of whistles and pots, which was made in old times in front of the house of an old widow who married again, and which still is made in some parts of France at the front door of certain people whose conduct is disapproved. In this sense the word "charivari" was also applied to political or social manifestations.

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The Introduction of General Anesthesia in Germany

WALTER K. FRANKEL*

SEVENTY years after the American people gained their freedom and independence, the young republic achieved a greater triumph for all mankind, liberation from the century-old, invincible tyranny of operative pain. October 16, 1846 will therefore always be a memorable day: for the first time an operation was performed in a great hospital under general anesthesia.

The news went from Boston to England. On December 18, 1846, the *London Medical Gazette* reported the operation at the Massachusetts General Hospital. Three days later, at the University College Hospital in London, Liston amputated the thigh of a man who, upon inhaling the vapors of sulphuric ether, could stand the operation without feeling pain.

It is not known through precisely what channels German surgeons became acquainted with this great invention, but the first German scientific publication dealing with the use of ether shows that the good news of general anesthesia reached Germany simultaneously from America and England. This paper, "On the use of sulphuric ether vapors in obstetrics," was read by Eduard Caspar Jacob von Siebold, professor of obstetrics and gynecology, before the Royal Society of Sciences of Goettingen on May 8, 1847 and published in the *Proceedings* of the Society (Fig. 1). In his introductory remarks von Siebold says: "Since the news of the use of sulphuric ether vapors in eliminating the pain of surgical operations came from America and England some months ago, it could easily be foreseen that this remedy . . . would soon also interest obstetricians in its use."

Indeed in Germany only a short interval of time elapsed between the first surgical use of ether and its obstetrical use. As far as we know, Heyfelder of the University Surgical Hospital at Erlangen (Bavaria) was the first surgeon in Germany to perform surgical operations on patients anesthetized by the inhalation of sulphuric ether. Four weeks after Liston's operation in London, and three months after Warren performed his first painless operation, Heyfelder used ether in operations. From January

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24 to March 17, 1847, he etherized 120 patients. Most of the operations were minor, but 20 were major operations.

In Vienna on January 22, 1847, Schuh began experiments with ether, subjecting dogs to inhalations. Having found these experiments safe and successful, he repeated them on healthy persons on January 25, and on January 27 he removed an aneurysm using ether narcosis.

In Berlin the first operation with ether narcosis was performed on February 6, the orthopedist Behrend operating successfully on a clubfoot. On the same day at Prague, Halla performed the first operation on an etherized patient. Two weeks later an obstetrician reported on the use of ether vapor in very painful labor pains: Hammer at Mannheim published his successful treatment in his home-town daily. Thus the *Mannheimer Abend Zeitung* (48, February 19, 1847, 191) has the glory of the first publication in German of the pain-eliminating influence of sulphuric ether inhalation.

In preparing this paper I was surprised to find that the earliest scientific reports on the use of ether in German surgery were published in the *Gazette Médicale de Paris*. In extended physiological experiments, the Association of German Physicians in Paris undertook regular observations of the influence of ether on human beings. The older men of the association administered ether to the younger men (men from 25 to 34 years of age) until complete insensibility was obtained; during this time changes of heartbeat and respiration as well as all other symptoms were recorded. Upon awakening, the young physicians gave reliable and clear information on their experiences during etherization. Nineteen young doctors participated in this experiment. By February 6th (the date of the first operations under ether at Prague and Berlin) the report of these experiments was published by the Association in the *Gazette Médicale* (6, 101) and the French editor called the publication "le document le plus intéressant . . . sur ce sujet."

A month later the *Gazette Médicale* (March 6, 1847, No. 10) published a report from Aronssohn, its medical correspondent in Strassburg, summarizing the experiences in Germany with ether. He reported that de Wattman in Vienna performed a resection of the lower jaw with etherization; the operation lasted 41 minutes, but the patient felt no pain the whole time. Schuh used ether for the extraction of a tooth and the amputation of a hip. Aronssohn also mentioned that ether was administered at the Veterinary School of Vienna for the castration of a stallion, and the horse remained motionless during the entire operation.

From Munich 4 cases of Rothmund were reported: a patient suffering from a stercoral fistula was treated with the cautery; under etheriza-

tion, the patient had an agreeable dream, but the muscles touched by the cautery showed strong contractions. The fourth case is of especial interest: the patient suffered from a strangulated hernia for 3 hours. Under the influence of ether the reduction was carried out very easily by simple taxis, while all manipulations used before etherization were fruitless.

In Augsburg, Reisinger treated 3 patients using ether inhalation: an amputation of a leg, a circumcision, and the cauterization of the hip in the treatment of coxalgia.

Fortunately the use of the cautery did not cause an ether explosion either in Munich or in Augsburg; it is evident from all the accounts that the administration of ether was stopped as soon as insensibility was reached and the cautery was therefore not so dangerous as it might be today.

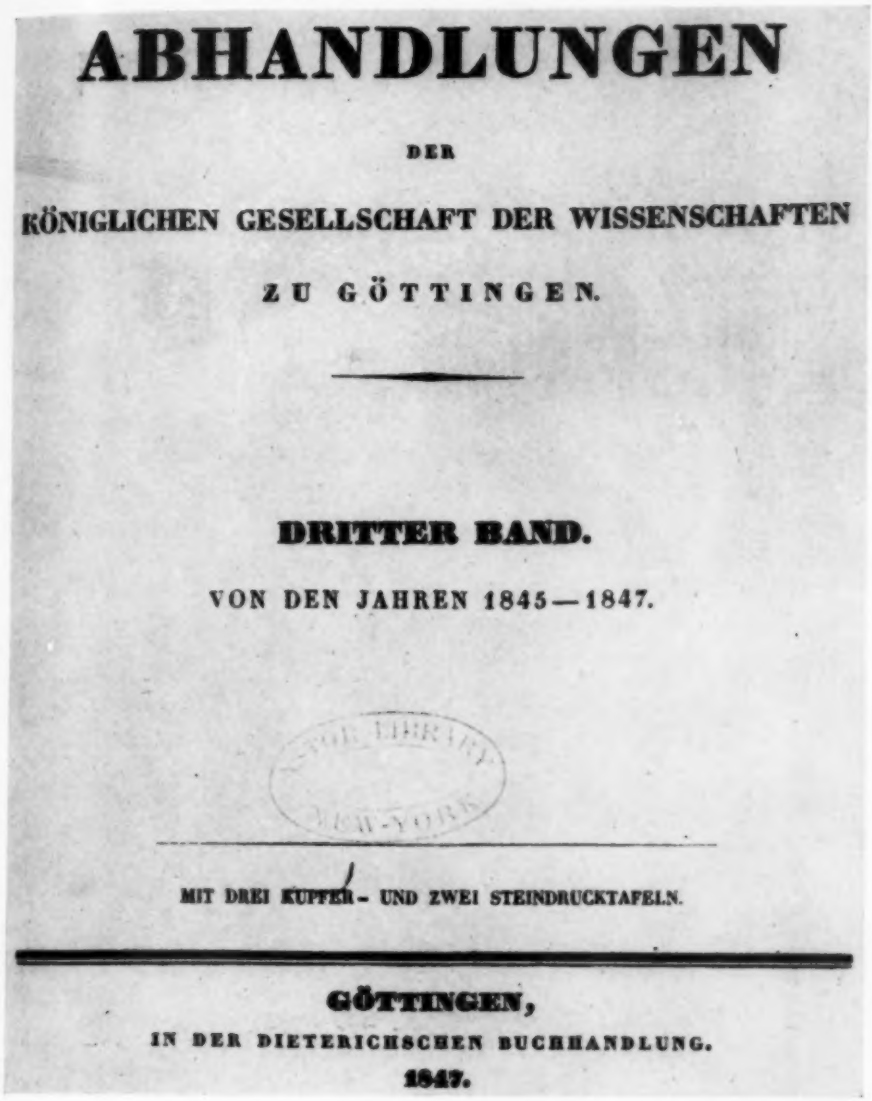
At Homburg near Frankfurt, Trapp removed 3 atheromas from the head of a patient, who was anesthetized after 8 or 10 inspirations of ether. Hammer's first obstetrical operation is also reported, as well as two others: an operation for strabismus and the removal of a tumor of the upper eyelid.

In Berlin, Dieffenbach used ether anesthesia in performing rhinoplasty on a 16-year-old boy whose nose was destroyed by a scrofulous ulcer. The preliminary trial-etherization was so complete after one minute of inhalation that artificial resuscitation had to be administered. When ether was administered for the operation it took two minutes to obtain an adequate effect; during the entire operation the patient remained motionless and felt nothing, although he was conscious and aware of all that went on around him.

Aronssohn also reported a meeting at the Berlin Charité Hospital on February 15, 1847, at which Juengken, director of the hospital, made public his experiments with ether in 6 successful cases. Especially convincing was the case of a patient suffering from a tumor albus with caries of the knee, and treated with a moxa (the old Chinese treatment) which was kept burning for five minutes. The patient awoke when the operation was over and assured the doctor that he would be able to undergo the operation.

The above notes show that the prodromal stage of anesthesia was the only method of etherization then used. It is therefore understandable why the first period of ether anesthesia in Germany was not marred by fatal incidents.

I believe that the most important factor in the general acceptance of ether anesthesia in major operations was von Siebold's paper before the



ABHANDLUNGEN

DER

KÖNIGLICHEN GESELLSCHAFT DER WISSENSCHAFTEN

ZU GÖTTINGEN.

DRITTER BAND.

VON DEN JAHREN 1845—1847.

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GÖTTINGEN,

IN DER DIETERICHSCHEN BUCHHANDLUNG.

1847.

FIG. 1. Title-page of *Abhandlungen* containing von Siebold's address to the Royal Society of Sciences at Goettingen.

FIG. 2. Wolf's sculpture group about the chloroform death of the bear of the Berlin Zoo.

Royal Society of Sciences at Goettingen, then the most influential scientific society in the German-speaking countries.

Von Siebold referred to only a few cases with unusual labor pains and to some other obstetrical operations, but he presented the question in such clear, careful, scientific language that the paper must be regarded as one of the classics of medical literature. In administering ether, he used a simple apparatus like that of Max Langenbeck of the Goettingen Surgical University Hospital. Von Siebold made his experiments in four different groups. First he studied the influence of ether vapor on healthy women who were not pregnant; then he studied the influence of ether inhalations on pregnant women and observed its action on the fetus; then he used etherization at normal deliveries; and finally he used etherization at obstetrical operations, especially those involving use of the forceps.

Von Siebold began his experiments on February 24, 1847. He remarks in his paper: "The first news of the use of sulphuric ether in obstetrics was received from Simpson, teacher of this specialty at Edinburgh." Von Siebold found the notice of Simpson's first use of ether, at a delivery on January 19, in the *London Medical Gazette* (January 1847, p. 218); on p. 212 of the same issue is the report that on January 25th, at St. Bartholomew's Hospital in London, Skey used ether at a Caesarean section. Von Siebold emphatically points out the importance of avoiding careless and reckless experiments, and he poses the question: Shall midwives be allowed to use this remedy? He gives us the interesting information that by April 6, 1847 the Hannoverian Ministry of the Interior had already published a law forbidding the use of sulphuric ether at operations performed by barber-surgeons and dentists unless a licensed physician was present. The *Gazette Médicale* (July 3, 1847, No. 27) contains an order of the Hessen-Darmstadt government forbidding the use of ether by health-officers, dentists, and midwives.

In all the early reports the use of ether inhalations is called etherization or ether narcosis. The technical term of the English-speaking countries, general anesthesia, was never accepted in Germany. More than fifty years later it was used for local and block anesthesia (*Lokal- und Leitungs-Anästhesie*). German physicians called the method *Narcose*, but the popular term for the new invention, *chloroformieren*, indicates clearly the important role played by chloroform in general anesthesia in Germany.

Ether could maintain its undisputed rule in general anesthesia for only one year. A rival suddenly arose, overshadowing ether inhalation in Europe for more than half a century. The general acceptance of chloroform by

German physicians was based on the authority of Simpson of Edinburgh who had first introduced ether inhalation into gynecological surgery. In November 1847 he published his observations on the new anesthetic and recommended it warmly because of its many supposed advantages over ether. In a surprisingly short time chloroform was the predominant anesthetic in Germany. It is particularly surprising, because at first there were fatal accidents from chloroform inhalations; the number of victims of ether inhalation was very small compared with the number of victims of chloroform inhalation. Indeed, the very first use of chloroform at Berlin resulted in a fatal issue, but far from becoming a warning of the dangers involved in the use of chloroform, the story became the source of much amusement to the inhabitants of the town. According to the story, King Frederick William IV was asked for an animal from the zoo for the first experiment with chloroform. By chance a big bear required an operation for cataract. The bear was operated on by the leading surgeon, Juengken, but didn't awaken from the chloroform narcosis; he was apparently a victim of chloroform.

The King found the premonitory death of the poor bear so amusing that he ordered Wolf, the leading animal sculptor, to make a witty memorial sculpture. The latter made a wooden group, giving the animals the features of well known Berlin physicians (Fig. 2). The little fox at the left of the first row has Juengken's features. A limerick contest was held and the prize-winning verses read:[1]

A dead man is the bear, I fear,
The reason, well, this chloroform here.
A consultation of medical men
Treated too humanly the animal then.
The foxlet grins, little bear will lament,
The wolf erects his monument.[2]

In a short time the number of deaths from chloroform increased remarkably, but all these serious failures and setbacks did not stop the popularity of the use of chloroform. After a few years chloroform had gained universal acceptance as the anesthetic of choice all over Europe. Binz has reported from his own experiences during the Austro-Prussian War in

[1] Der Bär ist nun ein toter Mann
Das Chloroform ist schulde daran
Ein ärztliches Collegium
Ging mit dem Tier zu menschlich um.
Das Füchslein grinst,
Das Bärlein flennt,
Der Wolf setzt ihm dies Monument.

[2] This translation is reprinted from Victor Robinson, *Victory Over Pain; a History of Anesthesia* (New York, Henry Schuman 1946) 233.

1866 and the Franco-German war (1870–71) that only chlorofom was used for general anesthesia. Although the statistical researches of the German Surgical Association in 1894 showed a ratio of 1:5.5 deaths from ether compared to deaths from chloroform (1 death from every 13,160 ether inhalations to 1 death from every 2647 chloroform inhalations), it took more than 25 years longer to eliminate the dangerous chloroform from surgery.

From the beginning Dieffenbach used ether. After a very cautious use at first, he became so enthusiastic that he wrote to the surgeon Stromeyer at Hannover in a famous letter (end of 1847):

> The wonderful dream that pain has been taken away from us has become reality. Pain, the highest consciousness of our earthly existence, the most distinct sensation of the imperfection of our body, must bow before the power of the human mind, before the power of ether vapor.

Development of Anesthesia in Germany in the Early Years of the Twentieth Century

R. J. WHITACRE AND A. P. DUMITRU*

IN THE hundred years since the introduction of ether narcosis into clinical medicine, anesthesia has developed from a mistrusted novelty into a specialty of great precision and complexity—and of undisputed value to the practice of surgery. Morton's demonstration in 1846 that sulphuric ether could effectively produce insensibility to pain during surgical procedures opened to medicine a vast new field of development. In fulfilling its primary purpose of alleviating pain, the introduction of ether anesthesia completely changed the surgical approach to many operations. Prior to the introduction of ether, the agony of the patient made speed the first essential of a successful operation. Now, with anesthesia, surgical procedures could be deliberately and carefully carried out, thus providing the surgeon with an immeasurably greater opportunity to obtain a successful result. Remarkable as this was, surgeons soon became impatient with the limitations of ether as an anesthetic agent. Experience with this drug revealed certain dangers, as well as inadequacies in its use. As a result, a quest for new agents and techniques began shortly after Morton's discovery and continues unabated today.

Although surgical anesthesia had its inception in the United States, American physicians were slow to recognize the potentialities of this field. Until the last two decades, most of the developments of lasting importance were made by European investigators, notably the scientists of Germany. One of the most fruitful periods in the history of anesthesia embraces the years immediately preceding and following 1900. This period saw in Germany the first use of many techniques and agents which have aided materially in widening the field of usefulness of anesthesiology. The perfection of the methods of local and regional anesthesia by such men as Braun and Schleich, Bier's pioneer research in spinal anesthesia, Fischer's synthesis of the barbiturates, Kühn's early steps in the development of endotracheal anesthesia, and the extensive investigation of intravenous anesthesia by Burkhardt, were all forward steps in the evolution of the new specialty. Many of these developments achieved immediate and lasting

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popularity, but others sank into oblivion as being impracticable. It is interesting to note that many of those methods which were then discarded have since been rediscovered or reapplied with successful results. The successes and failures alike, however, must be considered important as foreshadowing the present high development of anesthesiology.

Inhalation Anesthesia

In the field of inhalation anesthesia, two developments stand out as major contributions to the science of anesthesiology. The first was the introduction of the open drop administration of ether. In 1902, O. Witzel,[1] a Düsseldorf surgeon, advocated this technique, which remains today a favorite method of using this agent.

At the time Witzel wrote his paper on inhalation anesthesia, there were only two agents to be discussed, ethyl ether and chloroform. He dismissed chloroform as being unsafe because of the "paralyzing" effect on the heart and performed his operations under ether anesthesia. At that time the popular way of giving ether was by the "suffocation" method. A description of this technique impresses one that it was well named. The method required a large mask to cover the face, with the interior of the mask filled with gauze. Ether was poured onto the gauze and the excess shaken out; then the mask was placed over the patient's face and covered with a piece of oiled silk to exclude air. Thus the patient was deprived of an adequate supply of oxygen, and anesthesia was in large part due to asphyxia.

Witzel recommended that ether be given by dropping it onto a mask. When respirations deepened and the patient stopped counting, 20 drops of chloroform were added to "push the patient over into sleep." Then ethyl ether alone was continued in slowly falling drops. This technique was found to be much safer than the "suffocation" method. The patient was able to inspire needed air as well as the anesthetic vapor, so that the dangers of hypoxia were largely eliminated. Witzel also suggested, as a modification of this technique, building up a cone around the face, thus permitting a certain amount of rebreathing of the anesthetic vapors. Today this method, known as the "semi-open" system of anesthesia, is used extensively for the administration of volatile agents.

The second contribution to inhalation anesthesia was the development of the endotracheal technique. This method consists of the administration of anesthetic vapors by means of a tube passed into the trachea through

[1] O. Witzel, "Wie sollen wir narkotisieren?" *München. med. Wchnschr.* 59 (1902) 1993.

the mouth or nose. The advantages of endotracheal anesthesia are great, but it has developed into a procedure of major importance only during the last two decades. Its principles, however, were recognized and steps were taken to apply it clinically more than a half century ago.

In 1869 Friedrich Trendelenburg[2] devised a method of providing a patent airway for operations of the upper air passages by applying to man the principle of endotracheal anesthesia, which had first been used in animals by the English anesthetist, John Snow.[3] Trendelenburg, like Snow, introduced his tube through an incision made into the trachea. This tube carried an inflatable cuff which prevented the aspiration of blood and mucus into the lungs. Anesthesia was administered by dropping chloroform onto a gauze-covered funnel connected to the tube. The advantages of this method were appreciated, but it was not used extensively because of the mutilation involved in the preliminary tracheotomy.

The first steps in the development of modern endotracheal anesthesia were taken by William Macewen[4] of Glasgow, who in 1880 successfully performed an operation on the base of the tongue after first inserting a metal tracheal airway through the mouth. Although his effort had little practical success, it stimulated a search for a safe and efficient method of endotracheal intubation. The research of Trendelenburg and Macewen was continued by several European investigators who became interested in the advantages afforded by endotracheal anesthesia in surgery about the head and neck. In 1893, Dr. Karl Maydl,[5] professor of surgery at the University of Prague, in a discussion of anesthesia for otorhinolaryngologic operations, suggested that the entrance of blood and operative débris into the trachea could be prevented by the intubation of the larynx. Maydl packed gauze into the pharynx around the tube to provide an airtight connection between the trachea and the tube. In the same year Eisenmenger[6] described a semi-rigid tracheal tube carrying an inflatable cuff similar to the one which had previously been suggested by Trendelenburg.

Perhaps the outstanding pioneer in the development of endotracheal anesthesia in this period was the German surgeon, Franz Kühn of Cassel.

[2] F. Trendelenburg, "Beiträge zu den Operationen an den Luftwegen, 2. Tamponnade der Trachea," *Arch. f. klin. Chir.* 12 (1870–71) 121.

[3] J. Snow, *On Chloroform and Other Anaesthetics: Their Action and Administration* (London 1858) 117.

[4] W. Macewen, "Introduction of Tracheal Tubes by the Mouth Instead of Performing Tracheotomy or Laryngotomy," *Brit. Med. Jour.* (1880) ii; 122; 163.

[5] K. Maydl, "Ueber die Intubation des Larynx als Mittel gegen das Einfliessen von Blut in die Respirationsorgane bei Operationen," *Wien. med. Wchnschr.* 43 (1893) 58; 102.

[6] V. Eisenmenger, "Zur Tamponnade des Larynx nach Prof. Maydl," *Wien. med. Wchnschr.* 43 (1893) 199.

It was he who, with a greater understanding than any of his predecessors of the physiological as well as the physical processes involved in inhalation anesthesia, continued and improved their work. In a series of papers published between 1900 and 1912 he described most of the basic principles of endotracheal anesthesia as it is practiced today.

In 1901, Kühn[7] recommended the use of an oral endotracheal tube made of flexible metal, in order to eliminate the mouth and nose as respiratory passages and permit operations on the nose and throat without fear of obstruction. That he was aware of the work of Maydl and Eisenmenger is evidenced by the similarity of his device to the earlier instruments. However, he discarded the idea of the inflatable cuff, preferring to pack off the pharnyx with gauze. He recognized the possibility of trauma resulting from the introduction of a metal instrument, but concluded that this danger was minimized by the secretion of mucus.[8] He prevented glottic spasm by anesthetizing the larynx with cocaine, a procedure that is common practice in many clinics today. In 1902 Kühn reported the results of his work with nasal intubation.[9] At that time he felt the nasal route to be preferable, but since his later writings contain no mention of this method, it appears that he reverted to his original technique of oral intubation.

The value of endotracheal anesthesia in operations other than those of the upper respiratory passages was stressed by Kühn in a paper[10] published in 1903. He observed that operating conditions in the abdomen were greatly improved if the larynx were kept open mechanically by an endotracheal tube. With a tube in place the patient cannot adduct his vocal cords and "straining" during the operation is thus prevented.

The basis of modern anesthesia for pulmonary surgery was described when Kühn demonstrated in a series of three articles[11] that intubation provided the means whereby an adequate intra-pulmonic pressure could easily be maintained, thus preventing collapse of the lung when the pleural cavity was opened. He also reported his preliminary efforts to devise a completely closed system for the administration of inhalation anesthesia. For this purpose he invented an apparatus closely resembling the modern "circle filter" machine, employing caustic potash to absorb the exhaled

[7] F. Kühn, "Die Perorale Intubation," *Zentralbl. f. Chir.* 28 (1901) 1281.

[8] F. Kühn, "Technik der peroralen Tubage," *Deutsche med. Wchnschr.* 28 (1902) 539.

[9] F. Kühn, "Die pernasale Tubage," *München. med. Wchnschr.* 49 (1902) 1456.

[10] F. Kühn, "Kein Pressen und Erbrechen bei Narkosen," *Berl. klin. Wchnschr.* 40 (1903) 402.

[11] F. Kühn, "Perorale Tubagen mit und ohne Druck: I. Perorale Tubage und pulmonale Narkose." *Deutsche Ztschr. f. Chir.* 76 (1905) 148; "II. Perorale Intubation mit Überdrucknarkose," *ibid.* 78 (1905) 467; "III. Apparat zur Lieferung des Druckes für die Überdrucknarkose," *ibid.* 81 (1906) 63.

carbon dioxide. However, Kühn did not perfect this apparatus sufficiently to test it extensively upon human subjects, and his work was forgotten until Waters succeeded in applying clinically the technique of carbon dioxide absorption some twenty years later. Of the few weaknesses apparent in the work of Kühn, one was his lack of appreciation of the danger of the excessive dead space in the machine, which permitted carbon dioxide to accumulate. He was hesitant to use his apparatus also because of his uncertainty about the possible chemical reaction between the anesthetic and the caustic potash. Had Kühn been able to eliminate these obstacles, it is possible that the circle filter technique, which is in such common use today, could have been added to the equipment of the anesthetist at that time.

Kühn's work with endotracheal anesthesia was based on the inhalation principle, in which a wide bore tube is used and the patient actively ventilates his own lungs. During the period of Kühn's activity in the field of endotracheal anesthesia, the insufflation technique was introduced by Barthélemy and Dufour[12] of Nancy in 1907, and Meltzer and Auer[13] of New York in 1909. This method involved the forcing of anesthetic vapors under increased pressure through a small catheter inserted into the trachea, a procedure which eliminated the necessity of any respiratory movements by the patient. In spite of the considerable vogue enjoyed by the insufflation technique, Kühn steadfastly defended the inhalation method as a more physiological procedure. At a meeting in Berlin in 1910, he maintained[14] that the patient's own respiratory efforts were the most effective means of maintaining adequate ventilation. He also believed that his method of packing the pharnyx with gauze after the tube was in place was a more efficient means of preventing the aspiration of foreign material into the lungs than was the force of the outward flow of gases utilized in the insufflation method. Vindication of Kühn's viewpoint is found in the fact that the insufflation technique is today rarely used. The original inhalation method as advocated by Kühn is the procedure now employed with universal satisfaction.

Although Kühn did not believe the insufflation technique to be wholly desirable, he nevertheless investigated the possibilities of the method and suggested several improvements which have survived until the present time. He reported[15] in 1912 that if insufflation were used the catheter

[12] N. A. Gillespie, *Endotracheal Anaesthesia* (University of Wisconsin Press 1941) 15.

[13] S. J. Meltzer and J. Auer, "Continuous Respiration without Respiratory Movements," *Jour. Exper. Med.* 11 (1909) 622.

[14] F. Kühn, "Meltzer's Insufflation und meine perorale Intubation," *Berl. klin. Wchnschr.* 47 (1910) 1769.

[15] F. Kühn, "Meltzer's Verfahren und die perorale Intubation," *Zentralbl. f. Chir.* 39 (1912) 73.

should be inserted through a large endotracheal tube. This prevented the danger of emphysema by maintaining a full air passage at all times. He found that passing a small catheter through an endotracheal tube also provided an effective means of aspirating secretions from the tracheobronchial tree. This method of cleansing the lower respiratory passage is still effectively used by anesthesiologists.

In 1911 in Berlin, Kühn published his now little-known monograph, *Die perorale Intubation*, in which nearly the whole of his work is summarized. As Gillespie has said, "Kühn's work is now almost forgotten, but his publications remain the memorial of a man to whose ingenuity and original work anesthesia owes a great debt."[16]

In the early days of endotracheal anesthesia the tubes were inserted into the glottis by touch. Several authors described special curved forceps to hold the tube and facilitate its introduction. However, the difficulty of "blindly" introducing a tube impeded the progress of this method until the perfection of the direct vision laryngoscope made intubation more nearly certain. One of the early workers in this field was Alfred Kirstein,[17] a young Berlin laryngologist, who in 1895 invented a forerunner of the direct-vision laryngoscope. By the use of this speculum, which he called an "autoscope," a direct view of the larynx could be obtained. This instrument was little more than a specially shaped tongue depressor, over which a beam of light was directed, but it sufficed to allow direct exposure of the larynx. About this same time Gustav Killian,[18] the director of the nose and throat clinic at the University of Freiburg, modified Kirstein's laryngoscope by using a split tube which permitted better exposure of the larynx and made it possible more easily to pass a tube into the trachea.

From this time on there has been a gradual development not only in the construction of the laryngoscope but in the technique of intubation. At the present time a variety of laryngoscopes and endoctracheal tubes are available for this purpose. When one is familiar with the work of the German clinicians on endotracheal anesthesia, it is indeed remarkable that the widespread application of their discoveries was delayed for so many years. The immature status of surgery itself at the beginning of the twentieth century and the fact that physicians were only rarely devoting themselves to the specialized study of anesthesiology were undoubtedly important reasons why the work of these early investigators was ignored or forgotten for so many years.

[16] Gillespie, *op. cit.* 15.

[17] A. Kirstein, "Autoskopie des Larynx und der Trachea," *Berl. klin. Wchnschr.* 32 (1895) 476.

[18] C. D. Haagensen and W. E. B. Lloyd, *A Hundred Years of Medicine* (New York, Sheridan House 1937) 348.

LOCAL ANESTHESIA

German investigators pioneered also in the development of local, regional, and spinal anesthesia. A new era in surgery was opened in 1884, when the young Bohemian ophthalmologist, Carl Koller, demonstrated that cocaine possessed local anesthetic properties when applied to the eye.[19] The new anesthetic was immediately put to use in ophthalmology by Koller and his colleagues. In the same year, Jelinek[20] of Vienna used cocaine to anesthetize the nose and throat, thus providing the first effective local anesthesia for these areas and opening the way for the development of new surgical specialty. In succeeding years, local anesthesia was applied to many other parts of the body and became a method widely used by surgeons of all countries.

Until the early years of the twentieth century, cocaine, despite its great toxicity, remained the most popular local anesthetic drug. Due to its potency, excellent anesthesia was obtained by applying it topically to mucous membranes. Although it is not without danger, even when applied only to mucous surfaces, cocaine remains the most effective and most widely used of all the topical anesthetic agents, particularly in nose and throat surgery. Extensive research has been conducted for many years to find a drug less toxic yet equally effective for this purpose. To date no completely satisfactory substitute has been found.

The toxicity of cocaine when injected into the tissues of the body was soon discovered to be far greater than when the drug was applied topically. The high mortality rate of injection anesthesia with cocaine reduced its usefulness as a means of eliminating the pain of surgery, and a search for a means of increasing the safety of local anesthesia was immediately begun. This end was accomplished in three ways; by decreasing the necessary dose of the anesthetic, by retarding the absorption of the drug, and by developing agents which could be more safely injected into the tissues. This search was conducted by the physicians of Europe and America alike, but it is to the investigators of Germany, the birthplace of local anesthesia, that the greatest credit must be given for the development of the safe and effective techniques of local and regional anesthesia which are employed today.

The first major effort to increase the safety of injected cocaine was that of Carl Ludwig Schleich, who in 1892 introduced a new technique of local

[19] C. Koller, "Vorläufige Mittheilung über locale Anästhesirung am Auge," *Klin. Monatsbl. f. Augenh.* 22 (1884) 60.

[20] Haagensen and Lloyd, *op. cit.* 343.

anesthesia. Several years earlier, Liebreich[21] had shown that local anesthesia could be produced by injecting subcutaneously substances which were not considered to be true local anesthetics. Although he was able in some instances to obtain anesthesia with various chemicals, his results were not satisfactory. The period of analgesia was preceded and followed by intense pain, and the solutions caused damage to the tissues in some cases. Schleich, in continuing Liebreich's investigations, advocated the use of dilute solutions of local anesthetics. He realized that decreasing the amount of the drug injected into the tissues would lessen its toxic effect. Accordingly, he developed a technique of local infiltration[22] which proved to be safer and more effective than those previously used.

Prior to this time local anesthesia had commonly been produced by making one or more localized deposits of a highly concentrated cocaine solution, the depots thus formed serving to provide anesthesia of both the skin and the deeper structures. In surgery of the extremities an Esmarch bandage was frequently applied to help confine the area of anesthetization. The danger involved in the use of large amounts of cocaine and the unpredictability of the results made this so-called "secondary" type of anesthesia somewhat less than ideal. Schleich eliminated much of the danger of local anesthesia with cocaine by substituting for the few depots a series of carefully placed injections of a dilute solution of the drug. He first made intradermal injections along the proposed line of incision, each injection in contact with the previously made wheal. After the skin incision was made the deeper parts were infiltrated in a similar manner, thus providing a continuous area of complete anesthesia. By using this technique he was able to produce satisfactory anesthesia with concentrations of cocaine as low as 0.1 per cent, in sharp contrast to the 5 to 20 per cent solutions formerly employed. The advisability of using the lowest possible concentrations of local anesthetic drugs, so well demonstrated by Schleich, is recognized today as being of fundamental importance in anesthesiology.

While Schleich's method had added greatly to the safety and effectiveness of cocaine anesthesia, the problem of increasing its duration was not yet solved, nor were the toxic effects of the drug entirely eliminated. In the years immediately after 1900 German investigators made great progress in overcoming these obstacles by the introduction of vasoconstrictors and the synthesis of procaine. These two discoveries, coupled with the

[21] O. Liebreich, "Note sur l'anesthésie locale," *Compt. rend. Soc. de Biol.* 40 (1888) 340.

[22] H. V. Würdemann, "Explanation and Demonstration of the Infiltration (Schleich) Method of Anesthesia—Preliminary Paper," *J.A.M.A.* 23 (1894) 965.

work of Schleich, form the basis of present day local and regional anesthesia.

At the turn of the century, Heinrich Braun, one of the greatest of the early workers in the field of local anesthesia, demonstrated conclusively that the toxicity of cocaine was in direct ratio to its rate of absorption, and its efficiency in the reverse ratio. Thus any means of inhibiting the absorption of the drug should increase both the duration and the margin of safety of anesthesia. This principle had been employed to some extent in surgery of the extremities by the use of the tourniquet; in 1903 Braun suggested the use of the recently isolated suprarenal extract, adrenalin, as a "chemical tourniquet" applicable to all parts of the body.[23] That is, by the injection of adrenalin, which had been found to have vasoconstricting properties, the circulation of blood in the anesthetized part could be reduced, with a corresponding decrease in the rate of absorption of the anesthetic drug. The validity of Braun's suggestion was immediately confirmed clinically by many investigators, and the use of adrenalin was universally adopted. Today it is still commonly used for this purpose.

Although the use of vasoconstrictors greatly improved the efficiency of local anesthesia, the search for safer and more potent agents continued. Such drugs as tropacocaine, isolated by Giesel[24] in 1891, and eucain,[25] introduced in 1896, possessed certain advantages over cocaine but were not entirely satisfactory. Stovaine, named for its discoverer, Fourneau,[26] was widely used for a short time after its introduction in 1903. In the following year, the German chemist Alfred Einhorn synthesized novocaine, or procaine, which quickly superseded all its predecessors. Clinical investigation[27] showed procaine to be far superior to the drugs which had been introduced prior to this time. In addition to having excellent local anesthetic properties, it proved to be non-irritating to the tissues and to have a low degree of systemic toxicity. Today, procaine is still the most widely used of all local anesthetics and the standard by which other local anesthetic drugs are evaluated.

With the perfection of the technique of anesthesia by local infiltration,

[23] H. Braun, "Ueber den Einfluss der Vitalität der Gewebe auf die örtlichen und allgemeinen Giftwirkungen localanästhesirender Mittel und über die Bedeutung des Andrenalins für die Localanästhesie," *Arch. f. klin. Chir.* 69 (1902) 541.

[24] A. P. Chadbourne, "On the Value of a New Coca Base: Benzoyl ψ Tropein (Tropacocaine), as a Local Anesthetic," *Brit. Med. Jour.* (1892) ii; 402.

[25] G. Vinci, "Ueber Eucain, ein neues locales Anaestheticum," *Berl. klin. Wchnschr.* 33 (1896) 605.

[26] E. Fourneau, "Sur quelques aminoalcools à fonction alcoolique tertiare," *Compt. rend. Acad. d. Sc.* 138 (1904) 766.

[27] H. Braun, "Ueber einige neue örtliche Anaesthetica (Stovain, Alypin, Novocain)," *Deutsche med. Wchnschr.* 31 (1905) 1667.

German physicians turned to the study of other means of obtaining local insensibility to pain. An abortive effort in this direction was the attempt of August Bier[28] in 1908 to produce anesthesia of the extremities by the intravenous infusion of procaine. He was able to obtain adequate anesthesia by injecting the drug into a vein in an area of the extremity previously rendered bloodless between two tourniquets. The injected solution quickly permeated the entire area and remained until the tourniquets were removed. The method was successfully employed by several investigators and considered by such men as Braun to be of value, but it did not become popular and was soon abandoned.

Spinal Anesthesia

A logical extension of the principles involved in local and regional anesthesia—the blocking of sensory nerves by the direct application of anesthetic drugs—was the blocking of these nerves at their source, the spinal cord. It is not surprising that, as local and regional anesthesia became accepted techniques, the pioneers in this field turned to the problem of perfecting a way of safely introducing anesthetic drugs into the spinal canal.

At the turn of the century, the foundations of this method had already been established. In 1885, the American neurologist, Corning,[29] had treated certain painful diseases by injecting cocaine hydrochloride in the neighborhood of the spinal cord, and had suggested the possible application of a similar procedure to surgical anesthesia. In 1891, the German, Quincke,[30] had published the results of his use of lumbar puncture as a therapeutic procedure. However, it was not until 1898 that August Bier[31] of Leipzig earned for himself the title of "the father of spinal anesthesia" by combining the techniques of Corning and Quincke to demonstrate the feasibility of producing surgical anesthesia by the injection of anesthetic drugs into the spinal canal. Experimenting upon himself and his assistants, then finally upon six patients, Bier found that he could produce anesthesia of the extremities by the injection of 2 cc. of a 1 per cent solution of cocaine into the subarachnoid space. Bier's work was duplicated almost at

[28] A. Bier, "Ueber einen neuen Weg Localanästhesie an den Gliedmaassen zu erzeugen," *Verhandl. d. deutsch. Gesellsch. f. Chir.* 37 (1908) 204.

[29] J. L. Corning, "Spinal Anaesthesia and Local Medication of the Cord," *New York Med. Jour.* 42 (1885) 483.

[30] H. Quincke, "Die Lumbalpunction des Hydrocephalus," *Berl. klin. Wchnschr.* 28 (1891) 929; 965.

[31] A. Bier, "Versuche über Cocainisirung des Rückenmarkes," *Deutsche Ztschr. f. Chir.* 51 (1899) 361.

the same time by the Frenchman, Tuffier.[32] Other investigators, particularly in Europe, began to experiment with this dramatic method of producing anesthesia. It met with immediate approval and was soon in use in a wide variety of operations, having been introduced even into obstetrics as early as 1900. It was, in fact, so popular that Bier[33] in that year was moved to protest the reckless use of so dangerous a drug as cocaine and to plead for the development of less harmful agents and better techniques.

Bier's misgivings as to the results of overly enthusiastic acceptance of spinal anesthesia were well founded. Physicians soon reported complications ranging from headache to paralysis as aftermaths of the subarachnoid injection of cocaine, and the number of fatalities mounted steadily. Accordingly, the interest of surgeons, as in the case of local anesthesia, was directed toward increasing the safety of the method. The two developments which had proved to be of such value in making local anesthesia a useful technique were applied also to subarachnoid block. Procaine was used in spinal anesthesia[34] shortly after its discovery and was found to be safer than cocaine, though not entirely without danger. Vasoconstrictors were likewise employed in spinal anesthesia. In 1903, Dönitz[35] reported the successful results of his experiments upon animals with cocaine-adrenalin solution. In 1905, Klapp[36] demonstrated that the intradural injection of adrenalin decreased the rate of absorption of a lactose-salt solution, and found further that it was possible by the use of the vasoconstrictor to obtain in animals total anesthesia without toxicity. In that year Bier[37] applied these findings clinically, using cocaine-adrenalin spinal anesthesia in 305 cases. He concluded that the use of adrenalin with cocaine in man increased the duration of anesthesia and decreased the incidence of severe reactions. However, the use of a vasoconstrictor in spinal anesthesia did not gain the widespread popularity that it enjoyed in conjunction with local anesthesia. Although such investigators as Bier and Dönitz were enthusiastic in their endorsement of adrenalin as a means of decreasing the

[32] T. Tuffier, "Analgésie chirurgicale par l'injection sous-arachnoidienne lombaire de cocaine," *Compt. rend. Soc. de Biol.* 51 (1899) 882.

[33] A. Bier, "Bemerkungen zur Cocainisirung des Rückenmarkes," *München. med. Wchnschr.* 47 (1900) 1226.

[34] H. Heineke and A. Läwen, "Experimentelle Untersuchungen und klinische Erfahrungen über Verwertbarkeit von Novokain für die örtliche Anästhesie. 5. Erfahrungen mit Novokain in der Medullaranästhesie," *Deutsch Ztschr. f. Chir.* 80 (1905) 192.

[35] A. Dönitz, " 'Kokainisierung des Rückenmarkes' unter Verwendung von Adrenalin," *München. med. Wchnschr.* 50 (1903) 1452.

[36] R. Klapp, "Experimentelle Studien über Lumbalanästhesie," *Arch. f. klin. Chir.* 75 (1905) 151.

[37] A. Bier, "Ueber den jetzigen Stand der Rückenmarkesanästhesie, ihre Berechtigung, ihre Vortheile und Nachtheile gegenüber anderen Anästhesirungsmethoden," *Verhandl. d. deutsch. Gesellsch. f. Chir.* 34 (pt. 2, 1905) 115.

rate of absorption of spinal anesthetic drugs, many other physicians could find no value in its use. As a result, the subarachnoid injection of vasoconstrictors came to be considered as not only a useless, but a dangerous practice, and was for the most part discarded.

In spite of the efforts made to increase the safety of spinal anesthesia, patients continued to suffer untoward effects and the mortality rate remained high. As a result, the initial wave of enthusiasm for the new method of anesthesia subsided rapidly. The majority of physicians preferred to content themselves with the more reliable techniques of local and inhalation anesthesia, and the use of subarachnoid block became limited to a few enthusiastic champions of the method. It is only comparatively recently that the techniques evolved by the early German workers have been revived. With modern drugs and a better knowledge of physiology and pharmacology, present day physicians have modified and improved the pioneer work in this field. It is interesting to note that the possible value of vasoconstrictors in spinal anesthesia has again been investigated.[38] The clinical evidence presented to date indicates that it may be a useful technique in the modern application of spinal anesthesia.

Regional Anesthesia

The limitations of local infiltration and the dangers associated with spinal anesthesia led to a quest for other methods of applying local anesthetic drugs. It was this search that produced the specialized techniques of regional anesthesia, a method pertaining for the most part to the blocking of larger nerve trunks, often near their source of emergence from the spinal canal. The splanchnic, paravertebral, sacral-caudal and brachial plexus blocks are some of the more important types included under this form of anesthesia.

Hugo Sellheim[39] of Leipzig in 1905 first put into practice the idea of producing paravertebral blocks. By injecting drugs less toxic than cocaine close to the anterior roots of the 8th to the 12th thoracic nerves and by blocking the iliohypogastric and ilioinguinal nerves he was able to obtain satisfactory anesthesia of the anterior abdominal wall.

[38] F. T. Romberger, "Spinal Anesthesia—Practical Facts and Common Fallacies—Clinical Research on Prolonged Spinal Anesthesia Using Vasoconstrictor Adjunctives," *Anesth. & Analg.* 22 (1943) 252; M. D. Prickett, E. G. Gross, S. C. Cullen, "Spinal Analgesia with Solutions of Procaine and Epinephrine," *Anesthesiology* 6 (1945) 469; J. K. Potter and R. J. Whitacre, *Anesthesiology*, in press.

[39] H. C. Bumpus, "History of Regional Anesthesia in Urology," *J.A.M.A.* 96 (Jan. 10, 1931) 83.

Little interest was created in the method until Kappis[40] in 1911 perfected the technique by his extensive clinical experience. When the spinal nerves were blocked at their exit from the vertebral column some of the sympathetic ganglia were also anesthetized. The next step was to block the sympathetic plexus itself. Kappis found that by doing a splanchnic block he could obtain the profound intra-abdominal relaxation so necessary for good abdominal surgery. He used the technically difficult posterior approach to reach the sympathetic ganglia. In 1919 Braun[41] advocated the anterior approach which some men believed to be easier to perform. For example, Finsterer,[42] one of Germany's great surgeons, believed splanchnic anesthesia by the anterior route combined with a field block of the anterior abdominal wall to be the anesthesia of choice in gastric surgery.

Sacral-caudal block, another important form of regional anesthesia, is now used extensively in many clinics. Cathelin[43] in 1901 demonstrated that the anesthetic could reach the sacral nerves by injecting the solution through the sacral hiatus. The anesthetic drug is extradural and is believed by some clinicians to offer certain advantages over subarachnoid block of these nerves. In 1909 Läwen,[44] a brilliant young assistant of Trendelenburg, began a systematic investigation of the extradural approach to the sacral nerves. He perfected a technique of injecting the branches of the sacral nerves through the posterior sacral foramina. Excellent anesthesia could be obtained and parasacral anesthesia, as it was called, was soon used extensively by a number of surgeons. At the present time it is common practice to combine parasacral with caudal block.

The experience of subsequent investigators with these and other methods of regional anesthesia has demonstrated that the blocking of nerves to provide anesthesia of various parts of the body is a very practical procedure.

INTRAVENOUS ANESTHESIA

Intravenous anesthesia has reached a position of major importance in recent years. Much of the preliminary work in this field can be credited to the research of early twentieth century investigators.

[40] M. Kappis, "Uber Leitungsanästhesie bei Nierenoperationen und Thorakoplastiken, überhaupt bei Operationen am Rumpf," *Zentralbl. f. Chir.* 39 (1912) 249.

[41] G. Buhre, "Die Leitungsanästhesie bei Operationen in der Bauchhöhle und die Unterbrechung der Nn. splanchnici," *Beitr. z. klin. Chir.* 118 (1920) 51.

[42] H. Finsterer, *Local Anesthesia Methods and Results in Abdominal Surgery*, translated by J. P. F. Burke (New York, Rebman Company 1923) 92.

[43] F. Cathelin, "Une nouvelle voie d'injection rachidienne, Méthode des injections épidurales par le procédé du canal sacré," *Compt. rend. Soc. de Biol.* 53 (1901) 452.

[44] A. Läwen, "Über die Verwertung der Sakralanästhesie für chirurgische Operationen," *Zentralbl. f. Chir.* 37 (1910) 708.

The first instance of the intravenous use of anesthetic drugs appears to have been the work of the Frenchman, Oré,[45] who in 1872 obtained anesthesia by the injection of chloral hydrate intravenously. Since he had reported several fatalities, there was little interest in the method until after the turn of the century. In 1899, Dreser[46] of Munich introduced hedonal, but the possibility of its use as an intravenous anesthetic was not demonstrated until some years later when Krawkow[47] in Petrograd employed it with some success.

In 1908, Bier described his method of producing regional anesthesia in the extremities by the intravenous injection of procaine. In 1909, Ludwig Burkhardt reported his experimentation with the intravenous use of the volatile agents ether and chloroform to produce general anesthesia. At first, using chloroform in physiological salt solution in cat and dog experiments,[48] he met with but indifferent success. Chloroform adminstered in this manner was found to be no less dangerous than it was when administered by inhalation. Although minimal quantities of the drug were used, the toxic effects peculiar to chloroform still occurred. Continuing his experimentation with other drugs, Burkhardt in the same year enthusiastically reported success with the intravenous infusion of 5 per cent ether in both animal and human subjects.[49] He believed that the intravenous route of administering ether was superior to the inhalation method in that there was little or no excitement during the induction, and the sequelae of respiratory irritation such as coughing, laryngospasm, and cyanosis were materially decreased.

In a paper published in 1911, Burkhardt summarized his work to that date,[50] reporting the use of intravenous ether in over 250 cases. In addition to his work with ether, he had experimented with the intravenous infusion of a number of other drugs, including urethane, hedonal, chloral hydrate, veronal, and isopral. Of these, he considered only hedonal and isopral to be worthy of clinical use. The long lasting action of hedonal obviated its use alone, but in conjunction with ether it was found to be satisfactory. Isopral proved to be an effective agent for the induction of ether anesthesia, since its use shortened the period of excitation and promoted a smooth, rapid

[45] P. C. Oré, "De l'anesthésie produite chez l'homme par les injections de chloral dans les veines," *Compt. rend. Acad. d. Sc.* 78 (1874) 515.

[46] E. Dreser, "Ueber ein neues Hypnoticum aus der Reihe der Urethane," *München. med. Wchnschr.* 46 (1899) 1310.

[47] N. P. Krawkow, "Über die Hedonal-Chloroform-Narkose," *Arch. f. exper. Path. u. Pharmakol.* (1908, Suppl.-Bd.) 317.

[48] L. Burkhardt, "Ueber intravenöse Chloroformnarkose," *München. med. Wchnschr.* 56 (1909) 1678.

[49] L. Burkhardt, "Die intravenöse Narkose mit Aether und Chloroform," *ibid.* 56. 2365.

[50] L. Burkhardt, "Ueber intravenöse Narkose," *ibid.* 58 (1911) 778.

induction. In the years immediately following Burkhardt's publication, isopral and ether induction were used clinically by a number of physicians. In 1913, Graef[51] confirmed Burkhardt's work in a series of 510 cases at the Nuremberg City Hospital. Within a short time other investigators in America, as well as Europe, reported favorably on their use of ether intravenously. However, the complexity of the technique of administering anesthetic drugs intravenously prevented its general acceptance.

At the time of Burkhardt's work, it was considered necessary to expose the vein in order to insert a cannula. The inconvenience of this preliminary surgical procedure was a great factor in preventing the widespread acceptance of the method. With the experience gained in intravenous therapy in later years, the technique of performing venopuncture became greatly simplified. Now the intravenous route of administering anesthetic drugs is considered to be a relatively simple procedure.

A more serious objection to intravenous ether anesthesia was the necessity of using dilute solutions of the drug. To prevent the destructive effect of ether upon the blood cells it is necessary to avoid using concentrations greater than 7.5 per cent. Consequently it was often mandatory to give 2000 to 5000 cc. of solution to maintain an adequate ether blood level for surgical anesthesia. The intravenous administration of large quantities of fluid was inconvenient and often harmful to the patient. Although attempts were made to overcome this difficulty by adding other agents to increase the potency of the ether solution, the procedure remained for many years unsatisfactory for general use.

While the experience with intravenous anesthesia was not entirely satisfactory, it proved to be a great stimulus to other workers to develop drugs and techniques which could be used successfully. It demonstrated that the intravenous route provided the most direct way of applying drugs to the vital centers. The barrier interposed by the respiratory tract and lungs in inhalation anesthesia, and the tissues in the subcutaneous injection of drugs, were entirely removed. The possibilities were obviously apparent; it remained only to find an entirely suitable drug for intravenous administration.

The first step toward the answer of this problem occurred in 1902, several years before the beginning of Burkhardt's investigation, when the great physiological chemist Emil Fischer, with the assistance of J. von Mering,[52] synthesized the first of the barbiturates. This drug, called

[51] W. Graef, "Bericht über Erfahrungen mit den intravenösen Aether- und Isopral-Aether-Narkosen," *Beitr. z. klin. Chir.* 83 (1913) 173.

[52] E. Fischer and J. von Mering, "Ueber eine neue Klasse von Schlafmitteln," *Therap. d. Gegenw.* 44 (1903) 97.

veronal by its discoverers, had been suggested as a narcotic agent, but Burkhardt found it to be unsatisfactory for intravenous administration. Veronal was the first of a large group of synthetic hypnotic and sedative agents which have become widely used in anesthesia as well as in other fields of medicine. In 1924, Bogendörfer[53] reported upon the intravenous use of dial. This was followed in 1927 by Bumm's[54] work on pernocton. Other barbiturates, particularly sodium amytal and sodium pentobarbital, were found to be of limited value as intravenous anesthetics. However, the real stimulus to intravenous anesthesia was the development in the 1930's of the ultra-short acting barbiturates. Two German investigators, Weese and Scharpff,[55] introduced evipan in 1932. This drug, known in America as evipal, was immediately successful as an intravenous anesthetic. Evipal and later pentothal have been directly responsible for the development of the intravenous route as a major method of anesthesia. Although the barbiturates are by no means ideal as anesthetic agents, pentothal in particular has reached a tremendous degree of popularity and is now the drug of choice for intravenous anesthesia.

Twilight Sleep

One of the most widely publicized developments in anesthesia to come from Germany in the years immediately following 1900 was "Twilight Sleep." For a time it was considered to be the perfect obstetrical analgesia. This method was introduced in 1902 by von Steinbüchel of Graz, who observed that premedication with scopolamine and morphine induced forgetfulness of pain in childbirth. The use of these drugs in obstetrics was further developed and popularized by Gauss,[56] with whose name the method is now generally associated. The morphine relieved or dulled the pain and scopolamine produced the mental sedation and amnesia. Thus it was possible for labor to progress uninterruptedly without the patient being aware, or at least remembering, that she had suffered any discomfort. The use of this drug combination attained immediate popularity in Europe and America. Eventually certain disadvantages and dangers, particularly to the baby, were revealed as a result of its unbridled use. Its limitations are now fully appreciated and the method in most clinics is today applied only with caution in selected cases. Experience with "Twilight Sleep" in obstetrics

[53] L. Bogendörfer, "Ueber lösliche Schlafmittel der Barbitursäurereihe (Dial löslich)," *Schweiz. med. Wchnschr.* 5 (1924) 437.

[54] R. Bumm, "Intravenöse Narkosen mit Barbitsäurederivaten," *Klin. Wchnschr.* 6 (1927) 725.

[55] H. Weese and W. Scharpff, "Evipan, ein neuartiges Einschlafmittel." *Deutsche med. Wchnschr.* 58 (1932) 1205.

[56] C. J. Gauss, "Die Anwendung des Skopolamin-Morphium Dämmerschlafes in der Geburtshilfe," *Med. Klin.* 2 (1906) 136.

led to the realization that a combination of morphine and scopolamine was an excellent psychosomatic depressant and materially decreased the amount of inhalation anesthesia necessary. This drug combination is now extensively employed as preanesthetic medication.

CONCLUSION

Prior to 1900 the medical scientists of Germany made a number of outstanding discoveries that were later used for the relief of pain.[57] As early as 1540, Valerius Cordus contributed to the unborn specialty when he synthesized ether, the drug which was to become the most widely used of all anesthetic agents. Johann Sigismund Elsholtz may be credited with first attempting intravenous anesthesia in 1665. Chloroform, the second inhalation agent to be used extensively, was discovered by Justus von Liebig in 1831. The numbing effect of cocaine on the tongue was first reported by Albert Niemann in 1860, and August von Freund in 1882 discovered cyclopropane, the drug that was destined to become so tremendously important in inhalation anesthesia.

The early part of the twentieth century marked the first attempts to correlate on a scientific basis the knowledge gained in the past, and to apply clinically many of the earlier developments. The contribution of German investigators of this period is important because a number of their discoveries have retained until the present a place of importance in the armamentarium of the anesthesiologist. The basis of much that is valuable in present day anesthesia originated in the then unsuccessful work of these pioneers. The delay in immediate acceptance of some of these discoveries was due in part to the fact that equipment and technical skill were not sufficiently advanced to permit their development into workable techniques, and in part to the fact that there was only a sporadic interest in the problems of pain relief.

In the future, it is unlikely that the importance of anesthesia to the practice of medicine will again be unappreciated by physicians and by the public as a whole. The establishment of anesthesiology as a surgical specialty, the growth of journals devoted to the reporting of new developments, and the ever increasing interest of physicians themselves in the methods of relieving pain, are indications that new discoveries in the field of anesthesiology will not again go unrecognized.

[57] "A Chronology of Events Relating to Anesthesiology and Allied Subjects," in T. E. Keys, *The History of Surgical Anesthesia* (New York, Schuman's 1945).

FIG. 1. C. J. Ekströmer.

FIG. 2. M. Retzius.

The Introduction of Surgical Anesthesia in Sweden

G. LILJESTRAND*

THE slow diffusion of knowledge a hundred years ago, before the telegraph had revolutionized international communications, is clearly illustrated by the fact that the first use of ether anesthesia in England for extraction of teeth took place on December 19, 1846 and the first corresponding major operation two days later.[1] Thus more than two months had elapsed after Morton's famous public demonstration. For Sweden, a relatively isolated country, however, it was another month and a half before the news of this great advance spread.

On February 2, 1847 the chairman of the Swedish Medical Society at one of the regular meetings[2] read a communication from Berzelius, "namely an article from a French journal concerning the discovery by two American dentists, Jachson (*sic*) and Morton, who, by inhalation of ether, put a patient into an unconscious condition for some minutes; during this time surgical operations might be performed without the patient experiencing pain." Berzelius was one of the seven men who founded the Swedish Medical Society in 1807, and he took a great interest in it. Later, however, when he became wholly interested in chemistry and had become the secretary of the Swedish Academy of Science, his contributions to the Society were rather infrequent. That he now made this report to his medical colleagues signifies that he attributed great importance to the news. At the next meeting a week later[3] Berzelius sent further particulars, but the details are unknown. The Medical Society decided to ask Doctor C. J. Ekströmer, professor of surgery at the Caroline Institute in Stockholm and the foremost surgeon in Sweden at that time, to make experiments with ether at the Seraphimer Hospital (the Clinic of the Caroline Institute).

Great interest was soon aroused among the members of the Society. On February 9th, Doctor E. G. Palmgren[4] demonstrated an apparatus which he had made for the inhalation of ether vapor, and reported that he had tried ether in a dental operation. "The man being of an indolent temperament

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[1] A. D. Marston, *Proc. Roy. Soc. Med.* 35 (1941) 279.

[2] *Hygiea* 9 (1847) 580.

[3] *Ibid.* 9. 660.

[4] *Ibid.* 9. 659.

Doctor Palmgren did not wish to lay stress upon the statement of the patient that he had not experienced any pain." A week later (February 16th) Palmgren used an improved apparatus and stated that he had cut out a piece of wood from under the nail of a girl during ether administration.[5]

Ekströmer's report[6] was read before the Academy of Science on March 10, 1847 and is of considerable interest. Before ether was used on a patient it was tried by several of the assistants at the hospital in experiments on themselves.

> It turned out that the inhalation of ether through a suitable apparatus called forth, in some cases quickly, in some slowly, increased frequency of the heart beat with diminution of the force of the pulse, slow and silent respiration, relaxation of the muscular system, a feeling of numbness in the whole body, ringing in the ears, without extinction of the faculty of hearing, with maintenance of vision, though in some cases less distinct, with feeble gaze and dilated pupils, with dim consciousness of what was going on, and also of "immediate contact." In some cases susceptibility to painful impressions was maintained, in others complete suppression occurred, so that e.g. a lock of hair might be torn off, a needle thrust through the skin, and the like, without the maltreatment causing any pain, although the patient was conscious of what happened. In most subjects this was combined with an ecstatic state, a state of bliss for body and soul, of which nobody could give an exact account, because it was "indescribable." Some imagined they were floating in the air, delightfully rocking on light clouds. In some the inhalation of ether caused no obvious effect, in others it manifested itself in a form similar to ordinary drunkenness. The more complete effect of the agent when it developed appeared with varying speed in different persons after inhalation of 4 to 5 minutes, and continued only for one or two minutes after stopping inhalation, leaving the majority for a longer or shorter time in state of after-intoxication with discomfort, tiredness, heaviness, and giddiness. The exhalation from the lungs smelled strongly of ether for several hours afterwards.

This concise description gives an excellent picture of what we call stages I and II of anesthesia. Surgical anesthesia in the modern sense had evidently not been attained. This is in harmony with Berzelius's communication, quoted above, that unconsciousness was obtained for some minutes. Ekströmer in his report also mentions his experience with ether inhalation in patients, and it is obvious that he had used it only for short operations. One of his cases deals with the setting of a dislocated shoulder, which could be performed with "unusual ease" and without the patient feeling it. Another case was the application of red-hot iron on both sides of the spine which gave rise only to an agreeable feeling of warmth changing to

[5] *Ibid.* 9. 660.

[6] *Öfversigt af Kongl. Vetenskaps-Akademiens Förhandlingar* 4 (1847) 98.

lively pain, however, when the iron was held long enough to produce deeper effect. Ekströmer's greatest operation under ether seems to have been an amputation of a foot without the slightest pain. Probably such an operation at that time went rather quickly! Ekströmer emphasized that ether could give rise to very dangerous situations, especially in sensitive or feeble persons, and mentions a case of his own, where after only a few inhalations the pulse was almost impossible to perceive and at the same time froth appeared from the mouth and the patient became deeply unconscious. From his experience Ekströmer concluded that ether anesthesia was not to be recommended for operations of long duration or of a delicate kind, "where there is often a definite need of communicating with the patient."

The experiments of Ekströmer must have been quite convincing. About a month later (April 6th) O. A. Swalin, assistant surgeon at the Seraphimer Hospital, communicated to the Swedish Medical Society that he had used ether in three surgical operations.[7] In one of them the inhalation had to be discontinued owing to the bad condition of the patient, but in the other two, both suffering from cancer of the breast, it was used with advantage. In one of them the pain was slight, though the patient declared that she felt every cut of the knife. The second patient did not feel the earlier and major incisions but was extremely conscious of the later ones. At the same meeting another of the surgeons from the Seraphimer Hospital, V. Lundberg, declared that he had already tried ether inhalation in many cases[8]; in one of these the effect had been complete, though the operation was difficult, but in several others it had been of no use!

As a result of these experiences, ether anesthesia was definitely accepted in Sweden for surgical operations, though it required some time before it was used generally, or for prolonged operations. Ekströmer himself[9] tried a new way of administering ether by introduction as an enema (communication to the Swedish Medical Society November 16, 1847) and found this method valuable in a case of strangulated hernia. In the discussion which followed this communication Lundberg mentioned[10] that a practical method of administering ether by rectum was to place an ether bottle in warm water and connecting it by means of a rectal tube. In this way the ether was brought into the gaseous state. Ekströmer also called attention to the relaxing effect of ether on muscles during luxations as well as during the passage of renal calculi; in one case a stone the size of a hazelnut kernel was successfully passed during sleep induced by ether.

[7] *Hygiea* 9 (1847) 722.
[8] *Ibid.*
[9] *Ibid.* 10 (1848) 302.
[10] *Ibid.* 10. 303.

Meanwhile etherization had also been tried in another field. On March 30th, Dr. J. Elliot (later to become the teacher of the midwives in Sweden) called attention[11] to Simpson's work on the use of ether in obstetrics. In the discussion, M. Retzius, from 1849 professor of obstetrics and gynecology at the Caroline Institute, expressed doubts whether people should know of the use of ether during delivery, thus tempting physicians and midwives to use it before the effects had been completely investigated.[12] According to him "a natural process which under fixed regulation is inseparably associated with pain, must in some way become disturbed if the last-mentioned factor were to be artificially eliminated. The Divine Command imposed on woman from the beginning that she should bear her children in pain and sorrow, and surely no presumptuous human hand should unpunished try to alter in any way the orders of the Creator." Objections of this kinds had already been coming from other quarters, too. Retzius, however, does not mention any of these; he may therefore perhaps claim the doubtful honor of having discovered these arguments himself. Be that as it may, he fortunately did not follow this theological argument to its conclusion, and the opinions just quoted did not prevent him from using anesthesia in difficult cases of delivery.

The introduction of chlorofom as an anesthetic by Simpson in Edinburgh, at the recommendation of Waldie,[13] was soon followed almost everywhere by the substitution of the new agent for ether. In Sweden too, general enthusiasm for chloroform soon became evident. On December 14, 1847 Retzius spoke[14] about Simpson's work on the anesthetic properties of chloroform, "which are said to be much stronger than those of ether." He repeated the experiments and was able to confirm Simpson's claims that it acted more quickly and safely, that no special apparatus was needed for the inhalation, that the anesthesia lasted longer, and that the awakening was more quiet than after ether. On January 18, 1848 Retzius used chloroform in a difficult case of delivery.[15] The issue was successful, and the patient experienced no pain. At the next meeting of the Society (January 25, 1848) Elliot reported a similar case.[16] The delivery occurred spontaneously 17 minutes after the inhalation of chloroform had started; it must therefore have been an anesthesia of no short duration.

On September 26, 1848, Retzius gave a summary before the Society[17]

[11] *Ibid.* 9 (1847) 444.
[12] *Ibid.* 9. 452.
[13] A. J. O'Leary, *Brit. Jour. Anaesth.* 12 (1934) 41.
[14] *Hygiea* 10 (1848) 311.
[15] *Ibid.* 10. 317.
[16] *Ibid.* 10. 318.
[17] *Ibid.* 10. 629.

of his experiences with 12 cases of childbirth. He used only about half a Swedish "uns" (1 uns = 29.7 grams) of ether or chloroform for each patient. Administration was done simply with a handkerchief. The woman at first found the inhalation highly disturbing and tried to avoid it, but soon had a feeling of agreeable warmth. The pulse rate increased in the beginning to about 100 beats per minute, later it went down to 75–80 and even to 60–70, at the same time the face, which was at first reddened, became pale. (This change suggests the use of chloroform!) Respiratory rate at the start increased to about 36–40, but then decreased. The patient was in deep sleep, when the chin sank down to the breast and the arms fell down. (Probably a sitting position was used.) The pupils were dilated and the eyes moved to and fro. Reflexes were increased in strength. The description seems to correspond to the beginning of surgical anesthesia (stage III, plane I). The patient awoke after 4–5 minutes but could be brought into anesthesia again, if the handkerchief, once more charged, was held before the mouth and nose. The patients declared that they had had no lascivious dreams, such as had been mentioned by other authors. During the anesthesia a remarkable relaxation and distensibility of the perineal region were observed. The newborn children smelled of ether for several hours, but no corresponding smell was noticed with chloroform. Retzius pointed out that none of the patients to whom chloroform had been administered developed peritonitis, though a rather pronounced liability to this complication occurred at the clinic during the period concerned.

In the report for 1849 from his clinic (published in 1851) Retzius[18] mentioned that he had undertaken surgical intervention during the year in 18 cases, adding that most of these operations took place under chloroform anesthesia. In general no special apparatus was used, since the object could be gained by holding a handkerchief before the mouth of the patient, the nose being kept free to avoid asphyxia. Retzius still maintained his theological standpoint that anesthesia should not be used during normal delivery. (It is only in our own time that the opposite view has been brought into practical use.) But Retzius's report shows that it was then common practice to use anesthesia in difficult obstetrical cases.

There are other indications of the general recognition of surgical anesthesia at this time. In the only Swedish medical journal then existing, *Hygiea*, the number for August 1848 contains an advertisement that chloroform could be bought in bottles from an apothecary in Hedemora, a

[18] *Svenska Läkare-Sällskapets Nya Handlingar* 7 (1851) 1.

small Swedish town.[19] (Ether had a place in the Swedish pharmacopoeia since its first edition in 1775 and was thus easily accessible, but chloroform was new; it was introduced there as late as 1869.) The journal also contains several reviews and abstracts of foreign papers about anesthesia—and the means of preventing accidents, e.g. by bringing air or oxygen into the lungs by means of bellows. In 1850 *Hygiea* had a translation[20] of Velpeau's discourse "On Etherization," held at the annual meeting of the French Academy of Sciences of that year. His concluding words, "that etherization will stand as the most precious gift that surgery has given to mankind during the first half of the nineteenth century," without doubt also expressed the opinion held by Swedish physicians at that time.

[19] *Hygiea* 10 (1848) 512.

[20] *Hygiea* 12 (1850) 350.

Surgical Anesthesia in Spain

EDUARDO GARCÍA DEL REAL*

ETHER was employed as a surgical anesthetic for the first time by Long of Georgia in 1842. Nevertheless, this act was not sufficiently publicized, and history has conceded the glory of this discovery to the dentist, William T. G. Morton, who in February 1846 publicly demonstrated the anesthetic qualities of ether. Spanish physicians interested themselves promptly in this discovery, and immediately set about to learn the indications and contraindications for the use of ether as an anesthetic. In its list of prizes for 1847 the Academia de Esculapio offered a silver medal for the best memoir on ether as an analgesic.

The famous Spanish surgeon Diego de Argumosa y Obregon, celebrated as having been the first since Tagliacozzi and before Dieffenbach to perform autoplastic operations, and for promptly demonstrating as a fraud the famous wounds of Sister Patrocinio, was the first to use ether as a general anesthetic in various surgical procedures: on February 14, 1847 for the opening of an abscess of the neck, on the 15th of the same month for the opening of a mammary abscess, on the 18th for the resection of an exostosis of the humerus, and on the 26th he introduced a seton, under anesthesia, in a patient with purulent ophthalmia.[1] Argumosa is also worthy of being recorded as one of the precursors of Lister; he washed his hands before starting an operation, while other surgeons washed them after finishing.

According to their report in the second volume of *Anales de Cirugia* Benavente, Ruiz Gimenez, and Ulpiano Fernandez, of the Academia Medico Matritense, inhaled ether vapor until they were completely unconscious. In the course of his ether inhalation, Fernandez vomited, coughed intensely, experienced 4 or 5 convulsive contractures, felt a pain in the head, and a buzzing in his ears, which lasted until he was completely stupefied. Basilio San Martin explained these disturbances by the fact that Fernandez, who was a great admirer of England and the English, imitated them in everything, including a fondness for alcoholic beverages—rum, cognac, and the like. He was the first to observe and to point out the im-

* Real Academia de Medicina, Spain. Translated from the Spanish by Dr. George Rosen.

[1] *Boletin de Medicina, Cirugia y Farmacia* 62 (March 7, 1847).

portance of antecedent alcoholism for the disturbances supervening during general anesthesia.

At the Madrid General Hospital, ether was used as an anesthetic by Antonio Saez in the case of a 50-year old female patient, to carry out the complete extirpation from the right breast of a scirrhous tumor weighing 13¼ pounds. Before giving the ether by inhalation, it was administered in an enema, for which a drachm of ether and an ounce of distilled water were mixed just before the administration of the enema. It was given at 11 o'clock in the morning; in a quarter of an hour the patient felt warmth in her stomach and ether vapor in her mouth, and in a half-hour a numbness which made her close her eyes.[2]

In the same year, fundamental experiments were carried out on dogs in the Faculty of Medicine of Barcelona, before ether was used for human beings.

José Gonzalez Olivares, of the Faculty of Medicine of Santiago, was one of the first in Spain to recognize the advantages of ether anesthesia, publishing his observations in the *Boletin de Medicina, Cirugia y Farmacia* for July 1847.

In Spain use was made of the apparatus for ether anesthesia invented by Diego Argumosa and Basilio San Martin. The latter obtained the above-mentioned prize offered by the Academia de Esculapio. His memoir, presented in September 1847, was based on 53 observations that he had made himself. The anesthesia was repeated in various ways on some subjects, and San Martin etherized himself in 16 ways. This memoir was not printed, but was retained in the possession of his nephew, the famous surgeon, Alejandro San Martin.

Chloroform was used by the Medical Faculty of Santiago in experiments on dogs and rabbits. The chloroform was prepared by Dr. Casares according to the method of Soubeiran. It was then inhaled by some of the professors, Andres de la Orden, Gonzalez Olivares, and Vicente Guarnerio. Guarnerio, a very skillful surgeon capable of performing the most difficult surgical procedures, was the first in Spain to employ chloroform anesthesia. He used chloroform 18 days after Simpson published his discovery in Edinburgh on November 10, 1847.

In December 1847, under chloroform anesthesia, Gonzalez Olivares, of the Faculty of Medicine of Santiago, removed a mammary carcinoma together with the axillary glands. The operation was long and difficult. Several days later, also under chloroform anesthesia, he amputated the

[2] *Ibid.* 63 (1847).

penis of a soldier. Regarding chloroform anesthesia, Olivares remarked: "With ether we do not have the success that we do with chloroform; for the latter medium undoubtedly enables us to achieve that which we have sought for so long and so ardently."[3]

In Madrid the chloroform was prepared by the apothecary Diego Lletget, and then inhaled by Basilio San Martin, Lázaro, Saralegin, Asuero, Ataide, Santoro, Calvo, and Ulivarri. At the Hospital General, Basilio San Martin administered chloroform to a patient with a fistula-in-ano who was operated by Bonifacio Blanco.

From 1888 on, Professor Morales Perez, of Barcelona, used warm ether for anesthesia, a method developed by Diaz de Liano. When he presented his communication to the Fourteenth International Congress of Medicine, he had performed 4971 operations using this method of anesthesia, without having observed any respiratory complications.

The famous gynecologist, Fargas, employed chloroform and ether alternately for anesthesia. In 1896 Suarez de Mendoza recommended the use of a mixture of oxygen and chloroform, which he called the "Spanish method," and which he first announced in his brochure *La terapeutica quirurgica a fines del siglo XIX*. This method was employed by its author and by Eulogio Cervera in the Clinica del Rosario. It was likewise recommended by Alejandro San Martin together with an apparatus devised especially for the naso-pharyngeal insufflation of the oxygen-chloroform mixture. The proportion of the latter was not to exceed 8% of the inhaled mixture.

[3] *Ibid.* 105.

[4] *Ibid.* 106 (January 1848).

The Introduction of Sulphuric Ether and Its Substitutes in Portugal

AUGUSTO DA SILVA CARVALHO*

ON OCTOBER 16, 1846, at the Massachusetts General Hospital in Boston, John Collins Warren first used ether to obtain anesthesia in a surgical operation. In 1847 this method came into use in Portugal as it did in England and France.

The first Portuguese author to refer to sulphuric ether was Jacinto da Costa, who reported the effects of the inhalation of its vapors on the respiratory system but without reference to its lessening of sensibility.

On March 5, 1847, Adolphe de Mareille de Vitry, junior, who established his dental practice at Lisbon in 1835, advertised that he would use ether in his dental operations but there is no further record of such use in his advertisements. In a book published at the end of October 1847 he refers to the first surgical operation under ether in Portugal; this operation took place in May. Vitry received from Paris two inhalators, which he lent to the surgeons, but there is no record that he used them himself.

On April 12, 1847, a 24-year old woman fell from the first story of a house and sustained an injury in the region of the lower jaw; she soon developed trismus, tortura oris, spasm of the orbicular muscle of the eyelid on the same side and of the sternocleido-mastoid muscle, and vomited frequently. She was given warm baths and opium, and then ether with Walter's inhalator. At the end of four minutes she fell asleep; in this state the jaws could be separated and a wedge introduced. She awoke and asked for more ether, which was administered twice. Vomiting, sweating, restlessness, and lipothymia ensued, and she died the next day.

In April, Bernardino Antonio Gomes, professor of therapeutics at the school of medicine and surgery at Lisbon and director of the Marine Hospital, and his colleague A. P. Barral experimented with ether at the Marine Hospital on two of their students who volunteered. One of them, Antonio Maria Barbosa, who later became professor of surgery and a very famous surgeon, gave a complete account of his sensations during inhalation. In the same month A. J. Pinheiro, surgeon of the Hospital of San José, used ether when extracting a tooth. In the former case Walter's in-

* University of Lisbon, Portugal. Translated from the French by Miriam Drabkin.

halator was used; in the latter that of Statins. Gomes had imported these inhalators from London.

At its meeting on May 1st the Medical Society of Lisbon resolved to study this new method of anesthesia and to collect all the observations on its use. Here is a summary of the earliest ones.

On May 20th, the surgeon Cardoso Klerk was unable to obtain anesthesia for an operation of cancer of the jaw; but the following day he performed the operation even though the anesthesia was not complete. In the case of a man of fifty with a compound fracture of a finger that had to be amputated, ether was administered three times; but each time the patient was in a state of very great excitation and as a result there was imperfect anesthesia. The following day the same surgeon extracted two bladder stones, after three attempts with ether inhalation. The three patients recovered, and the surgeon concluded that the ether had no harmful effect and did not retard healing.

A few days later Joaquin Augusto da Silva in the Estrela Military Hospital used an inhalator borrowed from Vitry and amputated the arm of a man who felt a little pain only when the humerus was cut.

At a meeting of the Society of Medical Sciences, Ricardo Villalva Perez presented a paper entitled *Del uso del ether en les operasiones quirurgicas, y algunas consideraciones praticas sobre el mismo assunto*. In 1848 the following subject was proposed for a meeting of the society: to demonstrate the utility of ether inhalation as a preparation for surgical operations.

J. Teotonio excised a cancer from the lip of a woman and then performed chiroplasty, using Walter's inhalator. The surgeon Francisco Alberto d'Oliveira performed an amputation at the thigh of a man, using the same apparatus. The military surgeon Oliveira Velho, in the Hospital of S. João Novo, amputated the ulcerous penis of a sailor, using the same anesthetic. The surgeon J. M. Alves Branco removed a tumor from the arm of a 60-year-old man.

By August inhalators of the most recent design were in use in Lisbon. In Oporto in the autumn of 1847, L. P. Fonseca improvised and used an inhalator during two operations in the Misericordia Hospital—a case of castration and one of phimosis. Manuel Maria operated on another case of phimosis; Fonseca administered the anesthetic to the patient. The doctor who reported these cases used ether with good results during four operations.

The medical student Sousa Soares[1] translated an article from the *Revue*

[1] Although this author and the others here mentioned were born in Brazil, they are included here because Brazil was then a colony of Portugal.

Médical de Paris of 1847, giving the statistics of operations performed under ether in the hospitals of that city. Among them are mentioned the following, performed by Casado Giraldes: amputation of the thigh, two amputations of the great toe, a tumor, and a hydrocele.

In July 1847, L. de Castro Carreira, after making several experiments, used ether with an English apparatus, when amputating the femur of a Negress.

In November J. R. Nuñes (who at Paris belonged to the German Medical Society, in which students of that country performed experiments with ether upon themselves) published an article entitled "L'inspiration de l'éther pour prévenir les douleurs dans les opérations chirurgicales." The same month F. Ferreira d'Abreau published "Brève considération sur les inhalations de l'éther sulfurique dans la chirurgie comme anesthésique."

Benjamin Ward Richardson is regarded as having first used ether for local anesthesia on January 24, 1866, but in 1865 the *Dictionnaire de Médecine et Chirurgie Pratique* refers to the Portuguese doctor, Casado Giraldes, as having used a Luer vaporizer in order to obtain insensibility in minor surgical operations. He therefore deserves the credit for the first use of this type of anesthesia.

The dentist Vitry published a book on the use of ether as an anesthetic, but he said that he had not himself tried it, although he made French inhalators available to the surgeons. There then appeared in Portugal a number of original articles and translations from foreign journals on the history, effect, indications and contraindications of ether, descriptions of the most successful inhalators, and new uses of etherization.

At the end of 1847, upon the suggestion of Teotonio, J. M. Arnaut reduced a strangulated inguinal hernia using only etherization; he also quieted the powerful convulsions of a hysterical woman by the same means.

Later several dissertations on ether were written in the schools of Lisbon and Oporto. I mention only that of João Felix Pereira, *Anesthesia Chirurgica*, who gives great praise to Morton, although he had not read his book. He reports the experiments of Rénault and Amussat, the observations of Flandin and Vial, and the experiments of Roux, Pirogoff, and Parchappe de Rouen.

On November 25, 1847, R. S. de Bivar sent from Edinburgh an article on the anesthetic properties of chloroform. Several notices appeared in the foreign journals, to which Beirão referred at the December 15th meeting of the Society of Medical Sciences of Lisbon. Teotonio reported his ex-

periments on dogs with chloroform prepared by the pharmacist José Rodrigues. On January 12, 1848 B. A. Gomes first used this anesthetic on a patient of his colleague Barral in the Hospital of San José. The same month Cardoso Klerk used chloroform prepared by José Dionisio Corrêa for three operations. At Oporto the first application of chloroform was made on January 31. And on February 16, 1848, Dr. Manuel Pereira de Carvalho operated on an 18-year-old Negro at the Hospital of Rio de Janeiro. Later A. B. d'Almeida used it several times; and Sinwal used it for a confinement on May 27. A little later Magalhães Coutinho used it in Lisbon. R. S. Cide de Bivar, Professor of Obstetrics at Rio de Janeiro, published "Applications du forceps sous l'influence du chloroforme." On March 29, 1848, A. J. Peixoto published in the *Jornal do Comercio* of Rio de Janeiro "Accão do Chloroformio." In the provinces, the military surgeon F. A. Zamit used the same anesthetic; and several other surgeons employed it with success.

J. F. Pereira expressed the general opinion in Portugal that ether was the better anesthetic: "It is preferable for patients weakened by hemorrhage, suppuration, physical or moral excesses and impairments, and for children, old people, and nervous people." On the other hand less chloroform is required to produce anesthesia; it is easier to know when it is pure; it produces a shorter period of excitation; its action is more rapid, profound, and lasting; it keeps more easily; and no special apparatus is required to apply it.

In 1852, Casado Giraldes experimented on two young girls with amylene and concluded that it could be used in short operations, because anesthesia was obtained easily and there was no excitation. In May 1857 news came of a death noted by Snow, who had discovered this anesthetic. Nevertheless the anesthetic was used in 1857 by U. Teixeira, and later by Magalhães Coutinho, Farto da Costa, A. J. dos Santos, A. M. Barbosa, João P. Barral, and J. A. Arantes at Lisbon, and by Antonio Bernardino de Almeida at Oporto.

Nitrous oxide, known at Lisbon in January 1870 from a communication presented in 1869 by Jearmel to the Académie of Paris, was easily administered and produced anesthesia in less time and without excitation, but was less lasting and required special apparatus. The dentist Moisés Gonçalves, used it for a long time with an English apparatus.

J. Cloquet performed an operation on a woman anesthetized by hypnotism. Later in England, a surgeon amputated a man's leg by the same method. This became known in Portugal in 1843. At Lisbon, Professors

Arantes and May Figueira observed the complete insensibility obtained by using this method on a young girl of 13. In 1860 Almeida, in Oporto, could not obtain anesthesia in this way, but Vitorino Pereira Dias was more successful in a minor operation. In 1861, at Coimbra, I. R. da Costa Duarte and Philippe do Quental excised a cyst from a young girl hypnotized by means of a mirror. L. de Almeida and Mirabeau de Coimbra failed in similar attempts.

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The Introduction of Anesthesia in Cuba

JOSÉ LÓPEZ SÁNCHEZ*

Ether Anesthesia

THE discovery of anesthesia and its first use in Cuba, although published in a medical journal, *El Observador Habanero*, was made known to the medical profession in a daily newspaper of the Capital. On Saturday, December 26, 1846, in the *Diario de la Habana*, among various news items, an article entitled "A Substitute for Mesmerism"[1] told of the discovery of a method for mitigating pain by means of inhaling a certain gas which seemed to be a splendid substitute for the tedious practice of hypnotism to perform certain surgical operations.

On March 11, 1847, in the same newspaper, Vicente Antonio de Castro informed his colleagues and the public in general that he had made use of ether inhalation for the first time in Cuba, thus gaining for himself the great honor of being the one to introduce it into our surgical practice. He encouraged its use, offered his associates the apparatus for administering it as well as whatever information they might desire on the subject so that they might aid their fellowmen.[2] He was also the first to have medical students inhale it, so that he could know of its effects, and the first to make an apparatus to administer anesthesia.

"At 7 A.M. on the 15th of March, there appeared at the clinic of the Hospital San Juan de Dios a poor but neatly dressed gentleman, to be operated upon, with the use of ether inhalations, for two hydroceles which he had had for 18 years. I examined him closely with Dr. Esteban González del Valle and finding no contraindications and that the patient had not taken alcohol during the last few days, we resolved to operate upon him according to his wishes. He inhaled the ether and when, in 5 minutes, he lost sensibility but not consciousness, I introduced the trocar into the worst side, which was the left, since the injury to the integument was complicated by subfibrous cellular tissue. The serous fluid was removed, and we discovered that there was a cyst in the upper region. I

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[1] "Sustituto para el mesmerismo."

[2] Vicente A. Castro, "Aplicación de la fumigación del eter," *Diario de la Habana*, March 1847.

inserted the trocar into the cyst without removing the canula from its place, and as soon as the serous fluid came out I injected iodine. The patient felt absolutely nothing. I had the apparatus removed from his mouth, and I punctured the right side. The serous fluid came forth in abundance, and the patient felt nothing, but at the beginning of the second injection

FIG. 1. Vicente Antonio de Castro.

the patient said that he was feeling some pain. I administered ether again, and all pain disappeared until the operation was completed. There was a large crowd among whom was Dr. Sánchez, who asked me before everyone not to fail to cite him as a witness to the veracity of the demonstration. Sr. Mas and Dr. Valle, who assisted me in the operation, were also present.

"Immediately afterward, I asked if among the enthusiastic and brilliant students of medicine there was someone who wished to inhale some ether and give us an exact account of what he experienced. Sr. de Benítez pre-

sented himself and the following occurred: at the first inhalation, a slight cough; at the following two, incomplete attempts to cough; in a minute, complete sleep and total insensibility. He was pinched hard; he was pricked with pins in many places until blood appeared, and he remained insensible. The apparatus was removed, and not until he was fanned with a handkerchief did he regain consciousness, saying that he would like to continue sleeping and that he was very contented. It was necessary to make him touch the blood which he had lost and see the pin pricks in order to convince him that he had been pricked. He gave no further account of his impressions other than having coughed and been asleep.

"From these facts we deduce the following:

First, that the tin-plated apparatus is as good as the best one that can be invented or imported from Europe. Its sole defect is that it is not elegant.

Second, that inhaled ether stops tactile sensation and inebriates. But will the same reaction occur in all cases? We do not believe so, on the contrary we are convinced that in some cases it will excite the nervous system and perhaps exaggerate its sensibility. This will depend upon the constitution of the individual persons. But when this phenomenon is observed, the operation will be discontinued.

Third, that ether inhalations can be used with impunity, provided that there is no cerebral or pulmonary disorder.

Fourth, that prudence counsels that it should not be employed in operations for childbirth, especially if inertia of the uterus is expected.

"If new developments, favorable or unfavorable, should present themselves, we will report them faithfully. It is a question which is of interest to all humanity, for whose relief I have dedicated my life.

"Vicente A. de Castro"

This scientific work, the first original Cuban article on anesthesia, showed that Castro did not make casual use of the discovery; aware of its possibilities, he studied this problem, and not content with the opinions of others, he formulated his own. His keen clinical intuition is shown in his observation of the nervous excitement which may be produced by anesthesia and in his more important contraindication: the reference to disorders of the respiratory passages.

It was a peculiar quality of Vicente de Castro's nature that brought him the honor of being the first person in Cuba and Spanish America to make use of Morton's great discovery. His biographers relate that he was criticized for always siding with the latest opinion, and although they con-

sider this unjust and hasten to defend him, we must admit that the attraction to the new was what gave him the place he occupies in American medicine. His bold feat of introducing and promoting the use of surgical anesthesia, five months after its discovery in Boston and only eighty days after its first use on the old continent of Europe, indicates a most discerning intellect and an ardor for constant progress, especially if we consider that he did this alone. In his perpetual desire to strengthen his knowledge and in his eagerness to learn, he studied French and English in order to become acquainted with all the works being written abroad on medicine.

Thus Vicente de Castro demonstrated the surgical value of the practice of anesthesia in the Hospital San Juan de Dios, an old military hospital, first constructed in Cuba in 1568,[3] where he later gave free public courses in Descriptive Anatomy. Recognized by all as one of those who contributed most to the progress of medicine in Cuba, and as a far-sighted and observant professor, he was to bring renown to the Faculty of Medicine. He did not receive the homage of later generations for this valuable achievement, but rather for having established medical clinics and shown the importance of Pathological Anatomy.

During all of the year 1847 anesthesia by ether was practiced in almost all surgical operations. The *Diario de la Habana* published information from abroad and the correspondence of doctors describing the results of cases in which anesthesia was utilized. In this way, on March 31st, it was the same Dr. Castro who made known Charrière's apparatus for ether inhalation, and on November 13th he performed the first amputation with anesthesia.

Dr. Fernando González del Valle gave an account of the first failure to anesthetize a patient who had inhaled ether in great quantity, with Jackson's apparatus, over a period of six minutes. Dr. Priu recommended that a combination of morphine and ether be used.

[3] Perez Beato, "A Cuban doctor," *Anales hist. referentes a la Habana* 53. "1568. Under the provisional governorship of this island in 1565, of Dr. Francisco de Zayas, and with D. Pedro Menéndez de Avilés, as lieutenant governor, a military hospital was opened for the sick soldiers and sailors and especially for those who were in the campaign for the colonization of Florida.

"In the course of time, this hospital has been known by the following names: San Felipe el Real; Spiritu Santo (1609) for the province of that name in Mexico; Hospital Real (1613); San Felipe and Santiago for the feast day on which its church was consecrated; and San Juan de Dios, for the religious order which was in charge from October 14, 1603 in conformance with the Royal Decree of August 1, 1602. Today, it bears the name of Reina Mercedes. On May 6, 1596 it is mentioned as Hospital Nuevo and as such was taken over by the 'Juanino' brothers. These facts correspond with the records which we have consulted in which it is so named."

Henceforth, the name of Vicente Antonio de Castro should figure in the annals of Cuba's medical history, together with those of González Alamo who began the teaching of medicine, Tomás Romay who introduced smallpox vaccine, Nicolás J. Gutiérrez who founded the medical press and the Academy of Medical Sciences, Fernando González del Valle who created the Chair of Surgery, and Angel José Cowley who pioneered in Preventive Medicine.

The Practice of Anesthesia by Chloroform

In a memorandum entitled "Noticias concernientes a la historia de la Medicina en la Habana," submitted to the Academy of Medical Sciences by Dr. Nicolás J. Gutiérrez, he includes among his original contributions —without mentioning the date—that of being the first to secure anesthesia by the administration of chloroform, obtained by Dr. Luis Le Riverend, to the sister-in-law of the Count of Fernandina for the ablation of a cancer of the breast. Some historians fix the date as 1851.[4] Nevertheless, our investigations lead us to believe that the administration took place between January 26 and February 13, 1848.

There is no account of this operation either in medical literature or in the newspapers of the time. Perhaps Dr. Gutiérrez did not publish a report of the case since a prominent person was involved. This explains, confirming our previous opinion, why forty years later, when there was no longer a reason for withholding the information, he gladly offered it giving the name of the patient to guarantee its veracity, and to assure this valid contribution to history. And this is why, on May 19, 1849, in a report on an amputation performed under anesthesia by chloroform, he states the following: "A woman, who inhaled chloroform for the removal of a tumor of one of the breasts, moaned a little and spoke a few words. However, she said afterwards that she had experienced no pain and only remembered having suffered the discomfort or anguish which is felt when one has a nightmare." This leads us to assume that it is the first case on record in which chloroform was administered to produce surgical anesthesia.

On January 23rd, Dr. Luis Le Riverend procured some chloroform, and on the 26th he sent some of it to Dr. Gutiérrez to use on the first case for which he might have need of it. And on the 13th of February the *Diario*

[4] E. López, *Ojeada historica sobre la med. en Cuba*, and Rodriguez Molina, *Hist. de la med. en America.*

de la Habana reported that chloroform was beginning to be used in this city. We gather then that it was in this intervening period that anesthesia by chloroform was first practiced, that is to say, three months after Sir James Young Simpson had demonstrated its use to the Medico-Chirurgical Society of Edinburgh.

Ramón Zambrana was the first to describe the outward symptoms of anesthesia by chloroform, in an account of a ligation of the right femoral artery performed by José Atanasio Valdés on March 8, 1848, in the following manner: "But there is still greater medical glory for us in this spectacular case. In a few moments, the chloroform administered to the patient produced insensibility throughout the body, and, instead of uttering pitiful cries of pain while he was being operated upon he burst into song. This was not the exaggerated manifestations of violent delirium. Doubtless the chloroform produced intoxication analogous to that occasioned by some plants of the Solanaceae family. The patient, I repeat, did not experience the slightest pain and had no knowledge of the operation until the chloroform had been removed from his nostrils for several minutes and the action of this inestimably valuable agent was dissipated, and only then did he feel a fleeting, slight pain."

The first observation of death due to chloroform is not admitted as such by Dr. Gutiérrez, perhaps for fear that, before having a true perspective on the matter, doctors might be afraid of its use and deprive surgery and patients of this precious resource. After giving a detailed explanation of how the death occurred, he stated that it should not be included in the number of deaths occurring abroad without first noting the circumstances which accompanied it. In our opinion the patient died of a peripheral vascular syncope, caused by an excess of the anesthetic. Let us look at the case: " . . . and he was given chloroform. Before the end of two minutes he was in a state of complete insensibility in which he remained throughout almost the entire operation, and only at the ligation of the arteries did he moan a little and proffer a few words. The man in charge of administering this liquid had the patient inhale it again, and the state of sopor recurred. But then his pulse began to fail; his skin became cold; his face, heretofore pale and discolored about the eyelids and at other points, as a result of his fall, became more disfigured and more livid; his breath was coming slowly and with difficulty, and the entrance of air through the nasal fossae, their openings dilated by the exaggerated separation of the auricles of the nose, as happens with those who suffer from

asthma, came wheezing. His temples sunken and his forehead covered with sweat, the patient appeared to be at death's door. . . . A little ammonia was placed beneath his nose and he revived somewhat. He opened his eyes, breathed better and tried to say a few words, but he quickly declined into his former state. The continued administration of the alkali, which was also rubbed on the precordial region, dry friction on the body, epipastics, heat on the patient's extremities, Dr. Martin's malleus, and several small spoonfuls of wine and cordials, which he was able to swallow with some difficulty, had no effect whatever. He died about an hour after the operation. . . . This unfortunate case cannot serve as a reason for discontinuing the use of chloroform, thus depriving patients and surgery of a valuable instrument which, under certain rules and precepts, with some exceptions which study and practice will clarify, will give brilliant results in the future."

There are no records of operations by Dr. Nicolás J. Gutiérrez with anesthesia by ether. Instead, among those performed with chloroform he has a ligation of the left external iliac artery, on April 7, 1848. In spite of Dr. Castro's opposition to using chloroform because he did not think that the operation would be painful, he agreed to do so. This confirms our opinion that Castro had a mind open to every innovation, to every new discovery or theory. In the case of Dr. Gutiérrez, one would think that this agent would have merited his esteem and inspired him with greater confidence since it was a European discovery.

From 1848 to 1916 chloroform was the preferred anesthetic. European medicine, and especially the medicine of France, had a decisive influence upon us. Gutiérrez started the custom of emigrating to France and his example was followed by succeeding generations. Some went to complete their studies; others decided to do all their studying in Paris. It is for this reason that all our medical knowledge has a special character, impressed upon it by the School of Paris from which we have received every influence. From Paris came the texts which our doctors studied here or abroad. Borrero considers our medical group as a colony of that intellectual metropolis.[5] This explains clearly why chloroform maintained its supremacy for so long a time, because France preferred it, in spite of the opposition of the famous resolution of the Academy of Medicine of Lyons in 1857. It is not until the last years of the nineteenth century that chloroform began to be attacked by its adversaries. This opposition was started by those who

[5] Borrero Echeverria, *Notas biogr. y crit. sobre Lebredo* 539.

were educated in the United States, for example Carlos Finlay who practiced ophthalmology before devoting his scientific life to the task of proving experimentally that the mosquito was the carrier of yellow fever. Finlay always preferred ether and stated that he did not administer chloroform except when absolutely necessary. In order to substantiate his thesis he declared in 1884 that in the United States, England, and Germany ether was used more than chloroform and that only in France was preference given to the latter.[6]

[6] "Discusión del trabajo de Santos Fernández, Paralelo entre el eter y el cloroformo," *An. Acad.* 83.

Early History of Anesthesia in Ecuador

VIRGILIO PAREDES BORJA*

THE introduction of anesthesia into the Republic of Ecuador has not yet been treated by students of the medical history of our country. Gualberto Arcos gives no account of it in his *Evolución de la Medicina en el Ecuador*. For the study of this important subject we have utilized as our primary source the testimony of doctors who graduated from the year 1888 on. We interviewed these men and obtained from them significant data concerning this and many other aspects of the period, such as hospital, university and professional life and dominant medical doctrines. In addition, patients were consulted who had undergone surgical operations from the beginning of this century. We obtained carefully verified data concerning the first surgical clinic established in Quito, by consulting people living in the vicinity and persons who were operated upon in this clinic. We also spoke with the head of the oldest surgical clinic which still functions today in Quito, and examined account books of the old Hospital de San Juan de Dios, which was founded 382 years ago. Finally, data were sought in the archives and library of the Universidad Central de Quito.

Dr. Alejandro Bastidas, the oldest living medical graduate in Ecuador, received his medical degree in 1888 from the Universidad Central, and he is still continuing his extensive and unselfish work in the Hospital de Ambato. Dr. Bastidas entered as a student of medicine in 1882. He has informed us of the highly important fact that in that year the surgical patients of the Hospital de San Juan de Dios in Quito were anesthetized with chloroform applied by compress. From doctors and students he had learned that anesthesia was first introduced into Ecuador by the French professors Domec and Gayraud, who were invited to our country by President García Moreno. At that time, he told us, chloroform was used exclusively, and it was many years later that Ricard's apparatus was utilized. Anesthesia was becoming an ordinary practice in surgery, and it was employed by José M. Troya, Darío Echeverría, and Ezequiel Cevallos. Local anesthesia was never used, and was in fact unknown. There was no surgical clinic. Operations were performed frequently in the Hospital de San Juan de Dios and with comparatively good results. A few years after 1888 local anesthesia began to be used. Luis Anda and Eloy Rodríguez of the Hospital

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de Ambato administered chloroform as a general anesthetic in 1888, both by compress and with Ricard's apparatus. Anda, recently graduated, introduced anesthesia to Ambato, having learned the technique in Quito.

Lucindo Almeida Valencia, a first year medical student in 1881, and a graduate in 1893, tells us that from his first years as a student he saw general anesthesia practiced at operations in the Hospital de San Juan de Dios at Quito, it being no novelty for either professors or doctors. This leads us to assume that it had been in use for some years past and that it was not a recent innovation whose novel employment would have held the attention of doctors and patients for some time. Almeida Valencia observed the operations of Echeverría; his patients were anesthetized with chloroform administered by compress. Echeverría, curly haired, with a dark complexion, of good health and humor, was an energetic professor and a great conversationalist. He operated skillfully and was well qualified for his position as professor. He followed the French school, which dominated medical thought at that time. He did not perform laparotomies, but like the surgeons of that period, performed more amputations and hernias than anything else. The teaching of Echeverría greatly influenced the students of his time; his group of disciples later distinguished themselves in professional life.

By 1900, the first surgical clinic in Quito was open to the public on Plaza Victoria. In that year the Plaza had few inhabitants and was separated from the crowded urban center by the ravine of Jerusalén. The present inhabitants of Plaza Victoria with whom we have spoken believe that around 1900 there was a clinic in this quarter. This agrees with the important testimony of a house owner who acquired his property in 1903. At the time he moved in there was no clinic, but he was told that one had been closed a year or two previously.

Patients of ours who were operated upon in the Plaza Victoria clinic have told us that its director was René Quemarquer, a French surgeon, who brought with him assistants and personnel chosen from among his fellow countrymen. He performed all types of operations: trepanation, rib resection, laparotomy (certainly the first in Quito), nephropexy (also for the first time in Quito), surgery of the eye (among the first), as well as rhinological and gynecological operations.

These patients relate that when they were operated upon in the Clínica Quemarquer they were anesthetized with chloroform by compress, administered by a French assistant. The clinic was widely attended by both adults and children as a result of the fame enjoyed by its director, an

FIG. 1. Dr. Darío Echeverría performing an amputation on a patient anesthetized with chloroform administered by the compress method. Hospital de San Juan de Dios, Quito, 1892.

FIG. 2. Dr. Darío Echeverría performing a reduction of the tibio-tarsal articulation on a patient anesthetized with chloroform administered by the compress method. Hospital de San Juan de Dios, Quito, 1892.

affable young man who was well acquainted with the tastes and infirmities of his patients. The clinic was a novelty for Quito.

In 1908 Dr. Mario de la Torre came from Paris and founded his "Casa de Salud," the second in Quito, in Cotopaxi Street. He organized it as a surgical clinic and modernized the methods of caring for patients, the operative techniques, antisepsis and anesthesia, administering ether and chloroform by means of apparatus. It may well be said that de la Torre had one of the greatest influences upon the progress of contemporary surgery and upon the intellectual life of Quito.

In 1911 Isidro Ayora, Ricardo Villavicencio Ponce and Angel Sáenz founded the oldest surgical clinic which exists at present in Quito. Until that time the French school had served as a guide for Ecuadorian surgeons. In the new clinic the principles of the German school were followed, opening new paths for the progress of local surgery. Ayora, who graduated in 1905, told us that during his years as a student in the Universidad Central the patients were anesthetized with chloroform by compress, since no other anesthetics were known. Ayora was a distinguished teacher, and introduced modern techniques in obstetrics and gynecology, as did Sáenz in ophthalmology. Patients were already being anesthetized with chloroform, ether, local, subdural, and rectal anesthesia.

To President García Moreno we owe the introduction of anesthesia into the Republic of Ecuador. García Moreno, the outstanding Ecuadorian statesman, was a man of broad culture, and an enthusiasm for the natural sciences, physics, and chemistry. Tenacious and impassioned, he was endowed with a forceful character and used his strong will to carry out whatever he proposed to himself. He had high ideals, and governed with the purpose of obtaining a strong and progressive republic. Observing the backwardness of the instruction in our universities, he proposed to reform this situation. He observed the almost complete lack of scientific progress, and proposed to bring in European professors to teach the sciences and to create in this country the scientific culture of which we have been in such great need until our own day. He determined to train technicians, artisans, and artists to labor for national aggrandizement. Endowed with great talent, the President of Ecuador prepared his plan with care and executed it with celerity. To him we owe the new orientation of university learning and the new program for medicine. Before 1873 medical studies were almost entirely theoretical. Anatomy was learned from books rather than bodies, with only an occasional dissection or demonstration on a cadaver. The teaching of surgery languished under the same defects and its field was

quite restricted. There was no progress in the teaching of the medical sciences.

García Moreno assigned to Gayraud and Domec, surgeons from Montpellier, the task of revising in its entirety our outmoded educational system, granting them ample financial aid to bring from France all the instruments and equipment which would be necessary for the teaching and practice of anatomy and surgery. The French teachers set to work immediately and had instruments and equipment made to order by the firm of Robert and Collin in Paris. Arriving in Ecuador in 1873, they immediately took note of the defects of our plans of study and teaching practices. The Faculty of Medicine at Quito appointed Gayraud as their dean. By virtue of the authority thus bestowed upon him, he succeeded in formulating and gaining approval for a sound plan of medical study. In 1874 Dr. Domec was appointed Professor of Anatomy. He instituted laboratory instruction and systematic dissections on cadavers. This was made possible by the remarkably rapid construction of an amphitheatre for anatomy through the immediate financial aid of the President of the Republic. The same structure slightly enlarged still serves us today. Thus García Moreno was the instigator of our modern method of teaching anatomy.

From the end of May 1874, Dr. Gayraud, having brilliantly accomplished his task of reorganization, devoted himself entirely to the modernization of our surgical methods and practices and made the most valuable contribution to the progress of surgery in Ecuador. He introduced Lister's techniques along with chloroform anesthesia by the compress method.

Mention has already been made of the operative conditions in our country before the time of Gayraud and Domec. One can easily imagine the far-reaching effects of their innovations in painless and antiseptic surgery and of their introduction of anesthesia into Ecuador, twenty-eight years after its public acceptance in the unforgettable and dramatic operation of October 16, 1846 in the Massachusetts General Hospital.

As we already know, chloroform was used as an anesthetic for the first time by Simpson of Edinburgh in 1847, that is, one year after Morton's demonstration with ether. From England, where it began to be widely practiced, the use of chloroform passed to France and was more widely accepted than that of ether. Chloroform started fierce and almost ridiculous arguments among French doctors, for and against anesthesia in general and chloroform in particular. But with the passing of the years, experience,

which alone can settle the disputes of medical practice, brought about the acceptance of chloroform.

Gayraud thus brought us chloroform, which was used in France and was accepted by the majority of surgeons in his country. It seems that anesthesia by ether was introduced by Dr. Francisco Martínez Aguirre, educated in North America, who brought it to Guayaquil about 1890. Gualberto Arcos, in his *Evolución de la Medicina en el Ecuador*, says that it was Dr. Martínez Aguirre who introduced Lister's procedures into Ecuador. But, as we have seen, before the arrival of Dr. Martínez Aguirre, Gayraud and Domec had come from France, where the Franco-Prussian War of 1870–1871 had demonstrated to the most incredulous the efficacy of the techniques conceived by the genius of Lord Lister. Antisepsis was no longer being disputed, but on the contrary it was accepted as a blessing when Gayraud and Domec introduced it into Ecuador in 1874.

In 1875 García Moreno was assassinated. Gayraud and Domec felt the loss of the great statesman who had inspired and fostered their undertakings on Ecuadorian soil, and without finishing their task, which was already well under way and in great part realized, they returned to France and wrote: "If it was not possible to realize all the plans of García Moreno, there remains to us at least the satisfaction of having definitely assured the institution of practical studies in anatomy and surgery and of having *initiated one generation of the medical profession into the scientific procedures of which they were completely ignorant.*"

From the Abyss of Pain to the Summit of Anesthesia

CARLOS MARTÍNEZ DURÁN*

MAN has always suffered pain. The dawn and sunset of human life are pain and mystery. The biblical sentence, "In sorrow shalt thou bring forth thy children," has weighed upon sacred maternity through the ages. Sin and suffering preside as in a dialogue between brothers over the vicissitudes of life. Pain is the son of divinity, which purifies and exalts man. Saints, sages, philosophers, and poets have felt in flesh and spirit the sharp, biting blade of pain which lacerates endlessly. To be initiated into the arcana of truth and beauty one must traverse a sorrowful path, such as the Greek tragedians knew. When the chaste virgin embarks in the direction of Cytherea, she suffers, kindled with love, and tries like Aphrodite to rest upon the red and hypnotizing meadows of poppies.

Physical pain and moral anguish, which both may cause death, indorse human life and underscore it in red. Have not the great works of human thought sprung perhaps from the mysterious agitated abyss of pain? Crucified in fruitless expectation, Dante and Cervantes conceived their literary epics. And from the height of a cross Christ sent to the world the message of universal love and redemption.

But if pain is so great a purifier and carries us to the heights of creation, why has man sought and why does he seek with dexterity, to discover drugs which calm and mitigate pain? Men, and doctors in particular, do not work like the artist Oscar Wilde to transform the pleasure of a moment into the pain of a lifetime, but on the contrary they transform that perennial pain into the very great pleasure of feeling light-hearted, healthy and optimistic.

The fervor with which we today celebrate the centenary of the discovery of the anesthetic properties of nitrous oxide is nothing more than that constant eagerness which moves us to alleviate suffering and to ascend from the abyss of pain to the summit of anesthesia.

The medical sciences, through the centuries, have been steadfastly ascending to the summit of man's biological happiness. No one knows pain so well as the doctor. I remember with satisfaction that during my days

* An address delivered on Dec. 11, 1944, at a celebration of the centenary of the discovery of nitrous oxide anesthesia. Translated from the Spanish by Joan Knapp and Marie Fernandez.

as a student, when for the first time I crossed the silent threshold of an operating room and discovered the marvels of anesthesia, it brought to my mind, to the tip of my tongue, the majestic words of two French masters, Forgue and Dartigues, who in two exemplary books brought us the moral and aesthetic decalogue of surgery. Today, perhaps to the detriment of our creative and transcendental Latin spirit, the remarkable words of those French masters are being forgotten.

In rendering homage to Horace Wells, we make an apology for pain and we praise the conquests in the field of anesthesia, a word created by O. W. Holmes, the brilliant professor of Boston. I have always asserted, almost too strongly, that the great advances and discoveries of Medicine are due principally to the contemplation of human pain, which is triumphant in the hospital, in whose noble and saintly halls the best of the medical science and profession has been born. Furthermore, we are acquainted with the intransigence and prejudice of Academies and Faculties, at times opposed to all reform, as co npared with the clear understanding of those who have worked at the altar of all pain, the hospital bed. There come to my memory, fresh and fragrant, the words of that great master of Brazilian medicine, Miguel Conto. I will take advantage of this opportune moment to leave them engraved in the mind of teachers and students.

"The true study of medicine is made only in the hospital, by investigating, seeing, listening, and, it seems, almost by breathing the ambient air. The true love for Medicine is born and created only here, at the bedside of the sick, where pity for their suffering invades the heart and takes possession of it, where we are caught in the struggle between science and sickness and our whole soul trembles before that struggle. He who will not consider these passions, let him quickly reject the practice of an art in which he will be unnecessary, conquered, incredulous, and finally a defamer.

"A great professor of Medicine must be not only a sage and a philosopher, but also a great artist, passionately devoted to his work and able to inspire his pupils with a similar devotion. The soul of such a man will vibrate when in contact with these scientific activities, and he will know how to find aesthetic emotion in the arid depths, filled with pain and repulsive with diseases, and to communicate these vibrations verbally in order to interpret the emotion.

"To be near the bed of an invalid is to suffer. Everyone suffers his own pains; the doctor suffers the pains of all. Everyone suffers for his loved ones; the doctor suffers for his own and for those of his neighbor. Every-

one suffers through seeing suffering; the doctor suffers through seeing it and being unable to bring relief. Everyone suffers for what he sees, the doctor for what he foresees. Wherever man suffers the doctor will be, alleviating and mitigating pain, consoling. . . . "

I have recalled these beautiful words because they are fitting for our celebration. Besides being exemplary, they show us how the doctor has overcome pain, and how the surgeon has perfected his art and transformed it from the savage to the humane, from a martyrizing, hideous practice into a noble, moral, and aesthetic art. I have never been able to understand the humor of Bernard Shaw, who affirmed that ether and chloroform had made it possible for many imbeciles to be surgeons. We cannot forget that anesthesia, first, and antisepsis and asepsis, later, were the two great developments which made possible the progress of surgery.

We, who do not experience those hours of anguish and pain, when the surgical bed was a rack of torment and the surgeon an executioner, can scarcely imagine what an operating room was like.

Surgery is as old as human knowledge. Empiricism, born of necessity and observation, provided the first surgical techniques. They were all tried in the hope of obtaining narcosis. Neither the juice of mandrake, nor the Salernitan sponge saturated with opium was sufficient to mitigate the pain of operations. The nerve trunks were compressed by the method of Guy de Chauliac and Ambroise Paré, yet the pain continued to be excessive. Large quantities of alcohol were administered, but despite the efforts of the vivandière and nurse who acted as anesthetists, the surgeon opened the flesh amid cries and moans.

Every conquest in the field of narcosis seemed fruitless. In 1839, the great surgeon Velpeau stated prophetically: "To abolish pain in operations is a chimera which must no longer be considered." He was not very lucky in this and in other vain and ridiculous prophecies, for five years later came the revolution of anesthesia.

I shall not attempt to give you either a complete history of anesthesia or the biography of Horace Wells, which has already been described in dissertations prior to this one. Nevertheless, I wish to make a few philosophical reflections concerning the two surgical revolutions which triumphed in the second half of the nineteenth century.

The discovery of the anesthetic properties of certain chemical substances was the product of chance and curiosity. It was the result of what the French so aptly call "pour voir." Bold and ingenious chemists, curious professionals, guided by noble instincts, searched for new combinations of substances and made use of them in a certain manner. In this way, the

experiments with narcosis appeared here and there without deep reflection or clear method. It is certain that they did not all possess that innate curiosity for the new experiment, to see what follows it: Davy, Hickman, Wells, Morton, faithful to the philosophical precept of Hippocrates, profited by chance. These men clearly understood the significance of *opportunitas*, the *occasio fugax* of Hippocrates.

The Greeks deified Chance and represented it by a statue with wings ready for flight and with wild disorderly hair about to fall loose at any moment. Horace Wells, in that room full of expectation, followed their wise counsel, for he skillfully chose the opportune moment and swiftly and surely carried out the experiment to establish anesthesia by nitrous oxide. One could well say that the true mark of intelligence consists in profiting by the favorable and propitious moment.

When Davy, experimenting upon himself, discovered the anesthetic and inebriating properties of nitrous oxide and foresaw its future in surgery, when the English doctor Hickman obtained complete insensibility by using the same gas, they were standing on the road to the surgical ideal, in spite of the prejudices of the most notable men of science of that epoch.

Pain kills like a hemorrhage, Dupuytren used to say. A surgeon is a savage armed with a knife, William Hunter used to shout, not without thinking of his brother, John, for whom the operation was a humiliating spectacle for the vanity of science. Yet all these protests served for nothing, for the surgeons of the first days of anesthesia, like others who were laughing at Pasteur, blind before the evidence, bound by prejudice, immobile before new ways and reforms, scorned the men who had hit upon the secret of narcosis and abolished the violence and torture of surgical operations.

We come now to another philosophical consideration concerning anesthesia. The conservative English doctors, who had formerly opposed Jenner and vaccine, and puritanically implored God not to allow vaccination, insulted the country doctor Hickman, in the Medical Society of London. He had had the audacity to demonstrate to them anesthesia by laughing gas on animals and men. Incredulous, they first looked on in depreciative silence and then called him a dangerous dreamer, an idiot, a madman. Such was the reward for the man who was moved to study medicine by the contemplation of another's pain.

Disillusioned with events in his own country, he turned his eyes to Paris, and there too the academicians, who later cast aspersions upon Pasteur, called him ridiculous and insane. Magendie considered anesthesia an unworthy attempt, and only Dominique Larrey, the great surgeon of Napoleon, approved the method and even decided to test it on himself.

But the stupid Academy triumphed and Larrey's extravagant project was refused.

Anesthesia was undoubtedly a moral victory. Moreover, it made possible slow, safe, conscientiously performed operations, and was of especial benefit in abdominal operations. Nevertheless, the revolution of anesthesia did not yield the desired fruits. Although the operating room ceased to be a torture chamber and a rack of pain, and was transformed into a grave and silent temple, the still unknown bacteria spread death and despair. Pain had been conquered, but the next tragedy was lying in wait for its victims. It was the second surgical revolution which worked the miracle. And faithful to our philosophical concept, we must assert that in the history of human thought, of reason triumphant, the work of Pasteur is most notable, for it is the product of genius, profound reflection, and creative intuition. The discovery of anesthetics is more trifling, the product of bold ingenuity.

It would be ungrateful if on this occasion, dedicated to the triumph over pain, I did not devote a few words to the history of anesthesia in Guatemala. It was exactly four years ago, in December, that we met in this blessed house of pain, which is called Hospital de San Juan de Dios, to celebrate the practice of ether anesthesia in Guatemala. There are the commemorative plaques to record the event. It was in this blessed house, always filled with suffering, rich in a tradition which reforming impulses are trying in vain to eradicate, that Dr. José Luna tested etherism on November 30, 1847. It was here also that the students of medicine, Juan José Cañas and Felipe Arana, offered for the sake of science to be anesthetized by ether.

Close to these commemorative bronzes, another equally important plaque is disclosed today, in the name of the Faculty of Medical Sciences, who desired to honor a glorious event in universal Odontology. The virtues of the surgeon are extolled on this day, which is devoted to the triumph over pain. The gentle surgery which Nélaton used to love descends over the august silence of the operating room. The true surgical hands, strong and firm, as Celsus desired them, but for that no less gentle and caressing for the wounded flesh, will be everywhere triumphant.

Thanks to anesthesia, surgery is a wonderful art. Would God, that the ever greater legion of Guatemalan surgeons may never forget that "science and art without conscience destroy the soul." And that above all "to relieve pain is divine work."

Divinum est opus sedare dolorem.

The Introduction of Anesthesia in Venezuela

SALVADOR CÓRDOBA*

IN THE middle of the nineteenth century, distinguished doctors and surgeons, many of whom had attended the best centers and schools of Europe and possessed a vast store of knowledge, brought their learning to the Republic of Venezuela. They contributed to the scientific and cultural development of the country in the exercise of important official functions, teaching at the university, and in their professional work. There were numerous brilliant men, headed by the scholarly José Vargas.

Indeed, shortly after the recognition of general anesthetics in the world, surgeons of the period, among them many acceptedly competent foreigners who lent us their valuable scientific cooperation at this period of our medical history, had recourse to its use. It has so far been impossible to establish with certainty, by means of authenticated documents, either the date of the first use of anesthesia in Venezuela or the name of the surgeon who first employed it. Notwithstanding the discrepancies of opinion on this very interesting subject, I have prepared this study from all the most authoritative sources possible.

My friend, the distinguished doctor Santiago Rodríguez Rivero, confirms that Blas Valbuena, who had at that very time arrived from Europe, *used ether as anesthetic in Maracaibo in the year 1847*, one year after the introduction of this agent into the world. He had learned this fact from Francisco Suárez, to whom it was in turn confirmed by the eminent M. Dagnino of Zulia, the famous writer of memoirs.

In regard to the use of chloroform, I give the data given me by Vicente Peña, Professor of Therapeutics of the medical school of Caracas, taken from his doctor's thesis of 1902.

The history of anesthesia suffers from deficiencies that appear difficult to correct. There is a lack of surgical archives, and the only sources of information, verbal communications, differ about dates, events, and the like. Concerning the use of anesthetics in surgical interventions, for instance, some give priority to Eliseo Acosta, others to Guillermo Michelena, and others again to the Frenchman Carrón de Villards. With the above-mentioned reservations, and having used the greatest care in my research, I came to the conclusion that a surgical operation per-

* Academia Nacional de Medicina, Venezuela. Translated from the Spanish by Marica Horvat, New York City. This article was excerpted from a more general one on anesthesia submitted by Dr. Córdoba.

formed in the month of May 1849 *employed for the first time chloroform as an anesthetic*. The surgeon was Eliseo Acosta.

Later, Guillermo Michelena used the same agent. Other surgeons of the time and of the following generations used chloroform, with the exception of Luis Rodríguez, who always used ether.

P. D. Rodríguez Rivero tells me that even before the arrival of Carrón de Villards with the apparatus for administering chloroform, Joaquín Esteva had used the same liquid, probably in the form of compresses, for anesthesia in the case of the amputation of a lower limb. This operation took place in 1853 in the town of Maracaibo in the state of Xulia.

Dr. Rafael Guerra Méndez, Honorary President of the College of Medical Doctors and Corresponding Member of the National Academy of Medicine, says in a leaflet entitled *The Evolution of Medicine in Carabobo* and published on the occasion of the inauguration of the Medical College in Carabobo:

> In 1852 Guillermo Tell Villegas founded, with the permission of the authorities, a school of medicine at the College of Carabobo, of which he became Rector. The first professors were Manuel Maria Zuloaga, a disciple of Vargas, about whom the famous Eliseo Acosta had said that he deserved to occupy a post in the clinics of Europe; Pedro Portero, the noted scholar and expert surgeon; and José Antonio Zárraga, who was in charge of two chairs, namely that of Human Anatomy and that of Clinical Therapeutics.

The celebrated Estanislao Landaeta, a student at that time, in an article entitled "Here, Too, We Have Surgeons," published in the *Diario de Avisos y Semanario de las Provincias de Caracas* for 1856, describes several operations for cataract, performed by the above mentioned Zuloaga. We need say nothing more of this eminent master, except that his word was accepted with gratification, since it always contained some opportune lesson for his audience. In the same article Landaeta enumerates amputations of lower limbs, operations on anal fistulas, enucleations of the eye, incisions for calculi of the bladder, and treatments of urethral adhesions by gradual catheterization. These operations were performed by José Antonio Zárraga and Horacio Casaire. In an issue of *Lección Clínica-Quirúrgica* dedicated to the pupils of the national college of Carabobo, Zárraga describes a case of a perineal incision for the extraction of a calculus weighing five ounces. This operation was successfully performed on May 15, 1856. The patient had been previously chloroformed.

Until 1904 chloroform was the most accepted anesthetic in the practice of surgery throughout the world; at that time a reaction set in in France

against this agent, because of two consecutive deaths on the operating table due to chloroform accidents in the service of Nélaton. As a result of this catastrophe, chloroform began to be replaced by ether. Like chloroform, ether was first administered by the open method; drop by drop or by compresses. Shortly afterwards it was used through the apparatus of Laudau or the mask of Juillard. In the course of these events Ricard invented his apparatus for chloroforming, and after four years of experiment Ombredanne conceived and presented his apparatus for administering ether; it was based on the principle of inhaling boxed air, a mixture of pure air and ether, which could be administered at will. The good results obtained brought him universal prestige. A few years later Fredet invented his apparatus for giving chloroform, adapting in part the principle established by Ombredanne.

During my term of internship at the Vargas Hospital, up to 1910, the date of my medical degree, chloroform was the anesthetic in general use at this hospital, as well as among private patients. Ether was rarely used, mainly in cases where chloroform was contraindicated. In 1912 only did ether begin to win adherents, and its prestige grew with the knowledge and use of the apparatus of Ombredanne. According to the most recent statistics ether is now the anesthetic most widely used in the country. In its turn the use of chloroform is ever more restricted; only some gynecologists of conservative spirit have recourse to it, using it under the famous form of "the Queen's anesthesia," at the moment of the expulsion of the child. D'Empaire tells me that ether was introduced in Maracaibo, an important center of surgery, "more or less in 1912, and little by little it took the place of chloroform."

The passionate debates which arose in medical colleges and societies, following the accidents mentioned in the service of Nélaton, are still remembered. In spite of recognizing the speed and constancy of the action of chloroform, the complete muscular relaxation it affords, and the depth of the narcosis obtained through it, chloroform has been abandoned in favor of less toxic anesthetics, involving a lesser risk for the heart, faster elimination, and a greater margin of safety in its administration, both for the patient and the anesthetist. Ether, the anesthetic best known at the moment, fulfilled those conditions. Now, with the evolution of anesthesia in the past years, new substances have appeared which tend in their turn to replace ether.

Peter Parker and the Introduction of Anesthesia into China

EDWARD H. HUME*

NO Medical center in China is of greater historical interest than the Canton Hospital, founded in 1835. Although many of the steps leading to the establishment of this hospital are set down by Wu Lien-teh,[1] the detailed story of this notable institution was written by W. W. Cadbury and M. H. Jones in a centenary record in 1935.[2] The Canton Hospital was founded by the Rev. Dr. Peter Parker, "this great man, of whom it was truly said that 'he opened the gates of China with a lancet when western cannon could not heave a single bar.' "[3] Parker was a native of Framingham, Massachusetts. Born in 1804 he graduated in theology and medicine at Yale, was appointed by the American Board of Commissioners for Foreign Missions, and sailed from New York in 1833 on board the ship *Morrison*. Reaching Canton on October 26, 1834, he spent his first winter at Singapore and Malacca in the study of the Chinese language, but could not be restrained, even while studying, from opening a dispensary for Chinese patients. He treated more than a thousand patients between January and August 1835.

Returning to Canton, Parker opened on November 4, 1835, "a hospital and dispensary in Factory No. 7, Fung-taihong San-taulan Street, a site quite near the foreign factories. It was fortunate for the young institution that this building belonged to Howqua (his real name was probably Wu Tunyuen), the richest of the *hong* merchants and the only one who had with westerners other than strictly business relations. For he waived aside the rent which had been settled at $500 per annum."[4]

It should be noted that, thirty years earlier, in 1805, less than ten years after Edward Jenner's crucial experiment on James Phipps on May 14, 1796, Dr. Alexander Pearson, surgeon to the British factory, was responsible for the introduction of Jennerian vaccination into Canton. Sir

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[1] Wu Lien-teh, "Early Days of Western Medicine in China," *Journal of the North China Branch of the Royal Asiatic Society* 62 (1931).

[2] W. W. Cadbury and M. H. Jones, *At the Point of a Lancet. One Hundred Years of the Canton Hospital, 1835–1935* (Shanghai 1935).

[3] Rev. Dr. Beadle, quoted by J. C. Thomson in *Chinese Recorder* 19; mentioned by Wu Lien-teh, *op. cit.*

[4] Wu Lien-teh, *op. cit.*

Andrew J. Ljungstedt, the president of the Swedish factory in Canton and author of the book *Macao and China*, said in 1834, "Dr. Pearson will ever live in the memories of the foreign residents in China, as an attentive and sympathising friend, as well as skilful physician."[5] In 1820, a dispensary for Chinese was started in Canton by John Livingstone, surgeon to the East India Company, with the help of Rev. Robert Morrison, D.D., the first Protestant missionary to China, an appointee of the London Missionary Society (1807). In 1827 Dr. Thomas Richardson Colledge, another East India Company surgeon, began medical work for the Chinese at Macao; and, in 1828, with the aid of Dr. Bradford, an American physician from Philadelphia, he opened a free dispensary in Canton. It was his example, as well as his reports and papers that were instrumental in directing the attention of missionary circles in Europe and America to the splendid opportunities for medical missionaries in China, and to the early dispatch of the first and greatest of them, Peter Parker.[6]

Foreign merchants residing in Canton took great interest in the work of the Canton Hospital, known in Chinese as *P'u Ai I Yüan*, "Hospital of Universal Love." In 1836 an appeal was made for the launching of a medical missionary society; and, on February 21, 1838, under the chairmanship of W. Jardine (originally a ship surgeon to the East India Company, but later a business man in Canton), the Medical Missionary Society in China (actually the first organization of this sort in the world) was inaugurated in the rooms of the Canton General Chamber of Commerce. Dr. Colledge was elected president, with Peter Parker, W. Jardine, G. T. Lay, and E. C. Bridgeman vice-presidents, and Dr. Alexander Anderson, surgeon to the British factory, recording secretary. Howqua, a generous friend and helper of the work, was the only Chinese member of the society for many years. In an early report it was stated that "while the Society's agents, who will be looked for from Missionary Boards in Christian lands, will ply their art, they will educate young Chinese in it and reflex benefits will accrue to medical science from discoveries in China."[7] It is worthy of note that these far-seeing early founders recognized the real contributions that might be made to western medicine by a study of the medicine of China.

Ether was introduced into China by Peter Parker, who tells the story in the Report of the Medical Missionary Society of China—embracing the period from July 1, 1845 to December 31, 1847:

[5] Alexander Pearson, Report of 1916.
[6] Wu Lien-teh, *op. cit*
[7] Quoted by Wu Lien-teh, *op. cit.*

Operations performed on patients under the influence of Sulphuric Ether.

On hearing of the success of this new application of Sulphuric Ether, with such an apparatus as the Chinese were able to make, kindly furnished by a friend, it was administered to a Chinese of about thirty-five years of age, who had had a Steatomatous tumor upon his right arm, situated just over the biceps muscles, and about fourteen inches circumference. After inhaling the vapor three minutes, though able to return an intelligent answer to questions put to him, the tumor was quickly extirpated without sensibility either to the *knife* in making the incisions and dissection, or the *needle* in applying the sutures. The usual change was produced upon the pulse, first quickening it, from 75 to 100 and subsequently depressing it below the standard of health. There was less hemorrhage than ordinarily might be expected, and a manifest change in the color of the blood. The brachial vein which was exposed for several inches appeared as if injected with bluish ink, and the blood from the wound was very dark. The patient declared that though he knew the operation was being performed, he was scarcely sensible to the presence of the knife or needle. The same afternoon the tumor was extirpated, which weighed about a pound, he walked about the room, and as if nothing had happened. He slept quietly the following night. The wound healed by the first intention, not a teaspoonful of pus forming during the healing process, and in one week, simply required a few strips of adhesive plaster, and he was shortly after discharged, in the same good health in which he entered the Hospital.

No. 25,114. July 15th, 1847. *Moluscus.* Leangshe, aged forty, of the district of Nan-Hae, was affected with moluscus scattered over the person and face, most of them did not exceed the size of hazel-nuts, but on the left hip, one had attained a third the size of her head, hanging pendulous like a gourd. On administering the ether, first coughing, then nausea, and retching were produced, and the patient declined, after persevering for two or three minutes, to inhale more, and requested the operation to be performed, which she bore with fortitude. The insensibility was slight, if any. There was no artery which required a ligature. The patient readily and perfectly recovered.

Through the politeness of D. N. Spooner Esq. one of the Vice Presidents of the "medical missionary Society in China" I received from Boston the apparatus of Dr. C. Jackson, the *author* of this discovery, and a good supply of Sulphuric Ether, with a letter from the latter gentleman explaining particularly his mode of procedure.

No. 25,870. October 4th, 1847. I selected for its first trial a Chinese, a robust farmer, forty-nine years old, of the district of Hsu Shan, who had a steatomatous tumor, situated in the right axilla but distinct from the glands and nearly the size of his head. He was placed upon the operating table, in a sitting posture, ready to be laid down. He was then directed to inhale deliberately with full inspirations the Ether from Dr. Jackson's apparatus. I had hold of the right arm with one hand and the other behind him, ready to lay him gently down. In forty-three seconds, the muscles of his arm suddenly relaxed and he ceased simultaneously to inhale the ether, and in a state of insensibility he was laid back upon the table his head being still elevated. His pulse was quickened, and the eyes assumed a dull and vacant appearance.

The tumor was then extirpated by Kwan-Taon, my Senior pupil, and three arteries tied, in four minutes. There was not the slightest apparent consciousness during this part of the operation. As there was considerable oozing of blood, cold water was applied, and the wound exposed to the atmosphere for eight or ten minutes, before proceeding to apply sutures. By this time the effects of the ether upon the system had begun to subside, and the patient gave signs of sensibility to the prick of the needle, particularly in the parts nearest to the axilla, and after the wound was dressed and the patient placed in bed, he complained of the tightness of the sutures, but had no recollection of the incisions during the operation.

Symblepharon. The same afternoon, the Ether was administered to a man whose left eye had been closed for 15 years; the cillia were entirely obliterated and the tarsi firmly united except at the inner canthus, where there was a space large enough to admit a probe. The patient was very much exhilarated by the ether, and exceedingly amused the Chinese present by his facetious remarks. As the operation was simple enough, it was proceeded with, the patient talking through it, and on separating the lids with a scalpel guided by the probe, the eye was found perfect beneath.

The next day he desired the ether repeated for the pleasure it gave, and represented the operation of the preceding day as a pleasurable dream.[8]

It is of interest that Peter Parker also introduced chloroform into China. He reported it as follows.

CHLOROFORM

My acknowledgements are due to H. M. Schiefflin, Esq. of New York for an abundant supply of excellent chloroform, accompanied with the pamphlet of Dr. Simpson of Edinburgh upon this new anaesthetic agent. A brief allusion to this remarkable agent which the nineteenth century has brought to the relief of the afflicted is all that is here necessary.

The quantity of chloroform I have used with adults is about one drachm, *gently* inhaled from a sponge surrounded by cloth lined with oil paper to prevent evaporation. In some instances, a second application has been required.

Previous to receiving this chloroform from New York, I had failed in several instances with a vial obtained elsewhere, to get the patient under its influence. It was given to the lad, No. 28,307, but had he been told that the design was to destroy him, he could not have resisted it more violently. He said it was like scalding water. The same complaint had been made by others, but it was probably attributable to the quality of the article, no such effect being particularly noticed from that now in use.

Reports of disastrous effects from this agent have produced caution in its use, never administering it when predisposition existed to affections of the lungs, heart, or head. In the eight or ten instances in which I have employed it, *no unfavorable consequences have followed.* It has not been till recently that I have ventured to call in its aid in lithotomy, and that in the last two cases. In the first of

[8] P. Parker, *Report of the Medical Missionary Society in China; the Fourteenth Report of the Ophthalmic Hospital, Canton* (Canton 1848) 12–14.

them, before the patient became fully under its influence, there were momentary convulsions, but the man retained no recollection of them afterwards, and as already stated the sight of the calculus was his first intimation that the ordeal was past. In the second, the patient came speedily under its influence, without spasm, cough or nausea, and awoke from its effects as out of sleep. In cases Nos. 31,465 and 27,931, had a spectator come into the room in the midst of the operation, he would have supposed in the first that the patient was dead, and in the other that she was dying, yet no deleterious effects followed.[9]

I am indebted to Mrs. Henrietta Perkins, chief cataloguer of the Historical Library at the Yale University School of Medicine, and to Mrs. Wanda Mills, whose thesis on the work of Americans in China in the field of medicine will be published as a Columbia University study before long, for their aid in securing the facts and dates of the work done by Parker at the Canton Hospital in China.

[9] Peter Parker, *Minutes of the Annual Meeting of the Medical Missionary Society in China; and the Fifteenth Report of its Ophthalmic Hospital at Canton; for the Years 1848 and 1849* (Canton 1850) 29–30.

Notes on the History of Ether Anesthesia in Turkey

A. SÜHEYL ÜNVER*

IT IS well known that Hoffmann's drops made with ether have been used extensively in Turkey since the middle of the eighteenth century. However, that ether could be used as an anesthetic was mentioned for the first time in the two-volume treatise on *Medical Equipment* by Colonel Dr. Ahmet, written in 1871. Books on diagnosis written during the following years often mention this fact. Dr. Akil Muhtar Özden, in his recent book on *Pharmacodynamics*, notes that ether anesthesia was used relatively late in Turkey; chloroform was preferred to ether all over the continent.

Consultation of two Turkish surgeons who were active during the latter half of the last century also confirmed Özden's statement that a cautious administration of chloroform was then in more general use. Thus the former Surgeon-General Cemil Topuzlu states:

"From 1869 to 1870 I was in Paris. The French did not then use ether. On my return to Turkey, I too used chloroform for anesthesia. Later, I heard of ether anesthesia being used extensively in Europe, but I continued to use chloroform successfully until I left the Faculty of Medicine in 1912. But since 1924 I have been using ether in accordance with the regulations of the House of Health, where I have been performing my private operations. I have had no accident from the use of chloroform or ether.

"From 1890 to 1924, all surgeons working in private and general hospitals in Istanbul likewise used chloroform."

Surgeon Orhan Abdi Kurtaran, the retired professor of surgery of the Faculty of Medicine, states:

"When we were students in the Faculty of Medicine, our Professor of Surgery, Cemil Topuzlu Pasha, used chloroform for anesthesia. In 1898, when Dr. Rieder of Germany came to establish the Gülhane Army School for Applied Medicine, we observed that he used ether for anesthesia. In spite of that, chloroform was used more extensively in the country. In 1900 I went to Germany and there I noted that either ether or chloroform alone was used, but sometimes both were administered together. When

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I returned to Istanbul in 1905, I used only ether for my operations both at the School of Medicine and in the German hospital. I seldom observed pulmonary complications following the use of ether, and I never had a fatal case. All my colleagues in Istanbul then used chloroform. Once a year or so, I too used chloroform for cases of pulmonary tuberculosis. My students all also used ether anesthesia. Since no accidents occurred with ether, all of our noted surgeons eventually started to use it."

Thus we learn from these two formers teacher of medicine that those Turkish surgeons who had gone to study in France used chloroform and those who studied in Germany used ether for anesthesia on their return to the country. At the beginning chloroform was used more extensively; but since 1905 the use of ether as an anesthetic became more general. Surgeon Orhan Abdi Kurtaran is surely one of those responsible for the spread of ether anesthesia in Turkey.

Notes & Queries

Edited by MAX H. FISCH*

No ANSWERS have been received to Queries 1, 2, or 3.

In correction of Query 2, it should be said that the first published tract on the guaiac treatment was not Schmaus's but the anonymous *Ain recept von ainem holtz zu brauchen für die kranckheit der Franzosen* printed at Augsburg on December 1, 1518,[1] seventeen days before Schmaus's tract.

In a subsequent article,[2] I have called attention to a manuscript of 1519 in the Army Medical Library, containing a copy of a recipe for the guaiac treatment from Seville, Spain, which Giovanni Lorenzo of Sassoferrato, professor of medicine at Perugia, had obtained from a spice dealer on June 22, 1516. This recipe, I concluded, "now supersedes Pol's tract as the earliest surviving record of the use of guaiac in the treatment of syphilis." Answers to Query 1, however, may yet bring to light still earlier records.

To the account of Pol in the article just referred to, I should like to add the following chapter, based chiefly on Alfred Schröder's calendar of the correspondence of Veit Bild.[3]

Nicolaus Pol and Veit Bild

NICOLAUS POL, physician to the Emperor Maximilian I, left at his death in 1532 a library rich not only in medicine but in the sciences, philosophy, theology, astrology, humanist literature, the classics, and history. Some four hundred and fifty books and manuscripts bearing his signature, "Nicolaus Pol Doctor 1494," are known to survive.[4] Many of these he indexed and annotated. He was obviously a man of studious habits, and his learning was wide and varied if not profound.

Pol must have carried on an extensive correspondence with other scholars. Fortunately for his biographer, at least one of his correspondents was in the habit of keeping copies of the letters he wrote and received. This was the humanist monk Veit Bild (1481–1529) of the Monastery of Saints Ulrich and Afra at Augsburg. Three volumes of Bild's letters were preserved in the monastery library.[5] When it was dissolved, they passed to the Augsburg Diocesan Library.[6]

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[1] G. W. Zapf, *Augsburgs Buchdruckergeschichte* 2 (1791) 104.

[2] M. H. Fisch, "Nicolaus Pol Doctor 1494," *Bull. Hist. Med.* (July 1946).

[3] Alfred Schröder, "Der Humanist Veit Bild," *Ztschr. d. hist. Vereins f. Schwaben u. Neuburg* 20 (1893) 173–227. Efforts to secure copies of the letters themselves have been without result.

[4] A list of these, with their present locations, will be included in a volume entitled *Nicolaus Pol Doctor 1494*, shortly to be published by Herbert Reichner for the Cleveland Medical Library Association, which has the largest collection of strictly medical books from Pol's library.

[5] Placidus Ignatius Braun, *Notitia historico-literaria de codicibus manuscriptis in Bibliotheca . . . Monasterii . . . ad SS. Udalricum et Afram Augustae extantibus* 6 v. (Augsburg, Veith 1791–96) 4. 81–91, nos. xiv–xvi.

[6] Benedikt Kraft, *Die Handschriften der*

They contain eight letters from Bild to Pol and five from Pol to Bild, ranging in date from 1513 to 1520.[7]

Before entering the monastery as a scribe in 1500, Bild had studied at the University of Ingolstadt under Jacob Locher and Johann Stabius. Since he addresses Pol as his "ever-to-be-cherished teacher" (*praeceptorem suum in aevum colendissimum*),[8] it has been conjectured that he had also studied with Pol at Innsbruck shortly before 1500.[9] Pol is called "professor of medicine" both in the manuscript and in the printed editions of his guaiac tract. Since there was no university or medical school at Innsbruck in his time, the title probably means that he took private pupils, and Bild may have been one of them. It is just possible, however, that Bild refers merely to the instruction he received from Pol's letters.[10]

Bild entered upon his novitiate in 1503 and became a monk in 1504. He taught Latin and labored over Greek and Hebrew, but devoted himself more especially to mathematics, including astronomy, astrology, and geography. He wrote an astronomical calendar for Augsburg and vicinity. He made sundials on order from near and far—both stationary and portable, horizontal and vertical, with and without compasses—and sought constantly to extend his knowledge and improve his skill. He wrote also on music, liturgy, and hagiography. He admired Luther and was intimate with other reformers.[11]

Augsburg was not only a great publishing city but also one of the centers of the book trade. Innsbruck was neither. Pol therefore looked to Bild for news of the book world and used him as a purchasing agent. Bild looked to Pol for guidance in his studies, especially of astronomy, astrology, and dialing.

In the earliest surviving letter of their correspondence, early in 1513, Bild addresses Pol as "Nicolaus of Innsbruck, physician and astrologer most expert," says he is sending him Reuchlin's dictionary, and that the price is a florin. This was Reuchlin's *Rudimenta hebraica* (Pforzheim, Thomas Anshelm, 1506), which was both grammar and lexicon, and was intended to open the Hebrew text of the Old Testament to scholars who had hitherto known only the Latin Vulgate. It had been costly to publish and had sold slowly. In 1510 Reuchlin persuaded the Basel publisher Amerbach to take over the seven hundred copies he had left on hand at the reduced price of a florin for three copies. Even then Amerbach could hardly find purchasers, but Reuchlin bade him be patient, "for if I live Hebrew must with God's help come to the front."[12] The copy Bild bought for Pol sur-

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Bischöfl. Ordinariatsbibliothek in Augsburg (Augsburg, Haas & Grabheer 1934) p. 47, sec. B. IV. 18; p. 93, no. 81.

[7] Nos. 43, 44, 47, 78, 81, 85, 88, 89, 97, 99, 107, 115, 162 in the calendar appended to Schröder's article; cf. n. 3 above.

[8] Franz Anton Veith, *Bibliotheca Augustana* 12 v. (Augsburg 1785–96) 1. 14.

[9] Julius Hans, "Beiträge zur Geschichte des Augsburger Schulwesens," *Ztschr. d. Hist. Vereins f. Schwaben u. Neuburg* 2 (1875) 78–106, p. 98.

[10] Schröder, *op. cit.* (see n. 3 above) 180 f.

[11] Andreas Bigelmair, "Der Briefwechsel von Oekolampadius mit Veit Bild," *Reformationsgeschichtliche Studien und Texte* 40 (1922) 117–35.

[12] Ludwig Geiger, ed., *Johann Reuchlins Briefwechsel* (Tübingen 1875) 122, 180. Amerbach had been the instigator and publisher of Reuchlin's much earlier Latin dictionary, the *Vocabularius breviloquus*. Ludwig Geiger, *Johann Reuchlin* (Leipzig 1871) 88 f. (cf. p. 132).

vives in the library of the cathedral church at San Candido, along with other books by Reuchlin and his supporters in the great humanist struggle of the first quarter of the sixteenth century.

On May 13, 1513, Pol thanked Bild for books received, and gave him instructions for calculating nativities.

On July 18, Bild was grateful for "faithfulest instruction" and said that, as soon as he had access to the tracts of Ramon Lul, he would transcribe and revise them and send a copy to Pol. He asked Pol in turn for an example of the calculation of an eclipse from the Alphonsine Tables. The Lul tracts in question are perhaps the following four in one of the fourteen volumes of Lul manuscripts surviving from Pol's library at San Candido: *De arte disputandi; De XIV articulis fidei; Ars correlativorum; De natura.* The first of these was copied May 25, 1514, a little more than ten months after Bild's promise.[13]

On December 1, 1514, Pol sent a method for calculating the positions of the planets by the Alphonsine Tables, and asked Bild to buy him three books: (1) The *Theology* of John of Damascus in the Latin version by Lefèvre d'Étaples; (2) Lefèvre's edition of St. Paul's letters; (3) Lefèvre's collection of mystic visions, the *Book of the three men and the three spiritual maidens.* All three had been published at Paris by Henri Estienne, the first two in 1512 and the third in 1513.[14]

On January 19, 1515, Bild acknowledged a remittance to cover expenditures for books. Lefèvre's edition of St. Paul's letters, he said, was not to be found in Augsburg, but he had bought the John of Damascus from the bookseller Martin. He asked for further astronomical calculations.

On April 11, Pol ordered more books, and on May 1 Bild sent him the following four with a bill for 3 gulden and 24 kreutzers:

Symphorien Champier, *Practica nova in medicina.* s.l.a.t.[15]
Lefèvre d'Étaples (ed.), *S. Pauli Epistolae XIV ex vulgata editione, adiecta intelligentia ex Graeco, cum commentariis.* Paris, Henri Estienne 1512.[16]
Georg Tannstetter (ed.), Peurbach: *Tabulae eclypsium;* Regiomontanus: *Tabula primi mobilis;* etc. Vienna, Johann Winterburg 1514.[17]
Ramon Sabunde, *Theologia naturalis, sive liber creaturarum, specialiter de homine . . .* Strassburg, Martin Flach 1501.[18]

On May 13, Bild wrote that an Augsburg book dealer had recently received a shipment of many fine books. He had bought for Pol a small book by Champier,

[13] J. Rubió Balaguer, "Los códices lulianos de la Biblioteca de Innichen," *Rev. de filología española* 4 (1917) 303–340, pp. 316 f.

[14] A. G. Renouard, *Annales de l'imprimerie des Estienne* (Paris 1843) 10, 11, 14.

[15] HC*4907, Klebs 269.1, Ballard & Pijoan 80, unknown to Allut. Ballard & Pijoan (*Bull. Med. Lib. Assn.* 28 [1940] 186) date it "not before 1504, probably 1515." *Brit. Mus. Gen. Cat. Printed Books* 35 (1942) 314: [J. Mareschal: Lyons, 1515?]. Bild's letter shows that it was published not later than April 1515, more likely sometime in 1514 if not earlier.

[16] Or perhaps the 1515 reprint. Renouard, *op. cit.* (see n. 14 above) 16.

[17] Panzer 9.19.106.

[18] Panzer 6.26.3. Or perhaps Lyons, Balsarin 1496 (HC*14066). Pol's copies of both these editions are now at San Candido. Or possibly Paris, Barbier for Petit, 1509 (Panzer 7.538.325), in which case its present location is not known. Bild's letter as briefed by Schröder does not give the author but only the title "naturalis theologia." That sufficed for identification, for Ramon Sabunde, if not the originator of the phrase, was the first to use it as the title of a book; and so far as I know it was not again so used until after Pol's time. Montaigne, whose father had him translate the book in his youth, used it afterwards as a peg on which to hang his longest essay.

knowing his esteem for that author, but had not ventured, without a commission, to buy his *Speculum Galeni*.[19]

On October 12 Pol sent an exact calculation of Bild's nativity, and asked for a list of the books next reaching Augsburg from Frankfurt, Lyons, or Paris.

On October 26, Bild reported that the books from France and Frankfurt had not yet arrived. Of the particular books desired by Pol, the only ones he had been able to find in Augsburg were these:

Johann Werner (ed.), *Nova translatio primi libri geographiae Cl. Ptolomaei, etc.* Nuremberg, Johann Stuchs 1514.[20]
Johann Stoeffler, *Tabulae astronomicae.* Tübingen, Thomas Anshelm 1514.[21]

On May 2, 1516, Bild wrote that a lot of new books had arrived in Augsburg and inclosed a list of the medical titles among them. He asked Pol to instruct him concerning "directions of nativities," since he had found the canon of Regiomontanus too hard to follow.

On February 17, 1517, Bild offers "the true obedience of a disciple to his ever-to-be-cherished teacher Nicolaus Pol, subtlest investigator and doctor of medicine, astronomy, astrology, and nearly everything knowable."[22] He wonders why he has been so long without word from Pol. Presumably with a view to perfecting his compass dials, he asks by what methods, instruments, and observations the magnetic declination for Augsburg can be determined.[23] He reports that the Paris edition of Lul's works has arrived in Augsburg. (The vogue of Lullism in France was then at its height. Josse Bade had published a number of his works in 1515–1516, some of them for the first time.[24])

Pol was perhaps already preparing to leave Innsbruck on the medical mission sent by Cardinal Lang to Spain and Portugal to study the guaiac treatment of syphilis. His report was dated December 19, 1517. He made no reply to Bild until June 15, 1520, when he pleaded domestic misfortune and illness in excuse of his long delay. Without saying how it had been determined, he gave 11° as the magnetic declination at Innsbruck and said he believed the declination at Augsburg would be practically the same.[25]

No later letters survive, and it is not likely that any were written. Pol had stopped buying books[26] and was therefore no longer in need of Bild's services. Bild continued an active correspondence with other scholars for the next nine years, but had apparently no expectation of learning anything further from his ever-to-be-cherished teacher.

[19] Lyons, Vincent 1512. *Bibliotheca Osleriana* 2268. Ballard & Pijoan 93, unknown to Allut. Which small work of Champier's was bought by Bild for Pol, it would be hazardous to say. Of Pol's collection of Champier's works, which must have been considerable, a single volume is preserved at San Candido: the *De triplici disciplina* (Lyons, Davost 1508; Allut 8, Ballard & Pijoan 97). It is not a small book.

[20] Panzer 7.454.104. Now at San Candido.

[21] Panzer 8.325.33.

[22] Veith, *loc. cit.* (see n. 8 above).

[23] Ernst Zinner, "Die ältesten Räderuhren und modernen Sonnenuhren," *Bericht der Naturforschenden Gesellschaft in Bamberg* 28 (1939) 94.

[24] Rogent & Duràn, *Bibliografia de les impressions lul·lianes* (Barcelona 1927) nos. 57–60, 62.

[25] Zinner, *op. cit.* (see n. 23, above) 95.

[26] Of the books from Pol's library which can now be traced, only two or three were published after 1520, though he lived until 1532.

The very scanty indications in Schröder's calendar of Bild's correspondence[27] have served to identify only nine of the books he bought for Pol. Of these nine, only three are among the approximately four hundred and fifty books known to have survived from Pol's library. If this ratio holds for his entire library, it must have contained about thirteen hundred and fifty books.

A Note for Antivivisectionists

RECENTLY there has been serious antivivisection agitation in several of our major cities. Animal experimentation has played such an important part in the development of surgical anesthesia, one of mankind's greatest boons, that it seems repetitious and carping to have to remind the public of its benefits. The entire history of anesthesia from its beginnings illustrates this truth: the accomplishments of Hickman, Morton, Corning, Waters, and countless others would have been virtually impossible without preliminary trial on animals. Perhaps antivivisectionists would have preferred a different ending to the following story, told by Lord Playfair at the Massachusetts General Hospital's commemoration of the semi-centennial of Morton's first demonstration. Sir James Young Simpson once told Lord Playfair that he was dissatisfied with chloroform and was interested in finding a substitute.

> Lord Playfair a few days later announced to him that he had made the required discovery. The material that he intended to use was bi-bromide of ethylene. Sir James Simpson smelled the compound, and forthwith said that it was the very thing wanted. He was very anxious to repair immediately to Lord Playfair's private room and experiment upon himself.
>
> Lord Playfair was unwilling that the experiment should take place before further trial, and finally induced Sir James to have the anæsthetic tried on some rabbits first. The rabbits were accordingly treated, and were put away to await developments.
>
> On the next day Dr. Simpson appeared at Lord Playfair's laboratory, propped himself up with two chairs, and asked Lord Playfair for the solution. Lady Simpson, who was present, advised her husband to see how the rabbits had fared under the treatment before he applied it to himself.
>
> "When the attendant came in," continued Lord Playfair, "we saw him holding by the ears two rabbits—perfectly dead!"[28]

Since anesthesia is only one of thousands of medical advances made possible by animal experimentation and since continued medical progress depends upon such work, let us hope that human life will continue to be placed above that of the lower animals.

JOSIAH C. TRENT

Ed. Stafford

QUERY No. 8. In 1643 John Winthrop Sr., Governor of Massachusetts, received from London three sheets of coarse paper covered with "Receipts to cure various Disorders." The manuscript is inscribed "For my worthy friend Mr. Winthrop" and signed "Ed. Stafford." Who was this "Ed. Stafford?" Holmes, Packard, Viets, and Kremers have asserted that he was a physician. According to H. R.

[27] Examples of the identifying phrases: *Practica cum vocabulario Aggregatoris; tabulae eclipsium Burbachii; naturalis theologia; Verneri cosmographia; Stefflerini super coniunctionibus luminarium tabulae.*

[28] *The Semi-Centennial of Anæsthesia* (Boston 1897) 83.

Viets (*Isis* 23 [1935] 392), he was "probably the son-in-law of Elias Ashmole, the great Oxford collector." There are others who think that he was a lawyer.

JAN THORNTON
GEORGE URDANG

QUERY No. 9. Who was the author of the following book, listed in the *Index-Catalogue*, 1st series 13. 856?

Das Sündenregister der Medicinheilkunde. Allen Freunden der Gesundheit und eines Gott wohlgefälligen Lebens gewidmet von einem Arzte. 128 pp. 12°. Leipzig 1851.

GEORGE ROSEN

Société d'Histoire de la Pharmacie

M. LOUIS IRISSOU, Secretary-General of the Society, 150 rue de Belleville, Paris (XX^me^), has kindly communicated the proceedings of three sessions held during the spring of 1946. They give evidence of active and fruitful study of the history of pharmacy and of the lives of pharmacists in France from the sixteenth through the nineteenth century. The session of May 18 was devoted to Henri Moissan, Nobel prize winner in chemistry, in celebration of the sixtieth anniversary of the papers in which he announced his discovery of fluorine.

Wellcome Museum Library

DR. E. ASHWORTH Underwood, the Director of the Wellcome Historical Medical Museum, 183–193 Euston Road, London, N.W. 1, asks us to announce that a catalog of the extensive library of the museum is being prepared, but that it will be some time before this work will be published. Meanwhile, if any person who is preparing a bibliography of the works of any writer in the field of medicine or the allied sciences, desires to include the location of known copies of the different works, Dr. Underwood will be pleased to send him on request a list of the various works and separate editions of that writer which are in the library of the Wellcome Historical Medical Museum, and applications should be made to him in writing. It is hoped to open the library for the use of students at an early date, and an announcement will be made to that effect, but meanwhile the above particulars will be supplied on request.

The Northern Medical Association of Philadelphia, 1846–1946

The Northern Medical Association of Philadelphia will celebrate its centennial anniversary with a banquet at the Bellevue-Stratford Hotel, Philadelphia, on December 5, 1946. Dr. W. Wayne Babcock will be toastmaster and Professor Richard H. Shryock will deliver the centennial address. The occasion will also be marked by publication of an anniversary volume containing historical essays and photographs of the presidents of the Association from 1846 to 1946.

Book Reviews

HOWARD R. RAPER. *Man against Pain. The Epic of Anesthesia.* New York: Prentice-Hall, Inc., 1945. x+337 pp., illustrated. $3.50.

"THIS is the story of the most gracious, the most humane of all medical blessings—and of the biggest and bitterest of all medical controversies." With these words Dr. Howard Riley Raper, dentist and author from Albuquerque, New Mexico, begins what he properly terms the "epic of anesthesia." The fruits of twenty years of labor have been distilled into an absorbing and charmingly written story which appears appropriately enough on the eve of the one hundredth anniversary of the first use of ether as a general anesthetic at the Massachusetts General Hospital in Boston.

Dr. Raper's account is divided into four major parts, each subdivided into chapters. In part one, "Background," the author takes us back to the earliest known efforts of man to find some means to deaden pain. Thus in chapter One, "Quotes," we find references to pain and the use of anodynes in antiquity and the middle ages. Chapter Two takes up the use of such narcotics as mandragora, cannabis, henbane, opium, and alcohol. This is followed in chapter Three by a most interesting discussion of hypnotism in which the author points out that human gullibility is one of the most difficult of all human faculties to anesthetize. In chapter Four we learn of man's desperate efforts to seek relief from the pain incident to surgery, including the use of such radical measures as throttling and even clubbing patients into insensibility. Finally, in order that the reader may have a proper understanding of what these early attempts at anesthesia meant, Dr. Raper gives a short but vivid account of early surgery, concluding with a chapter called "Screams." After reading this chapter the reader himself feels the need of an anesthetic.

The dramatic story continues in part two. Raper has called this section "Discovery, the story of success." Here he presents in detail the already familiar account of how modern anesthesia was finally made available to man. He tells first of those who came close, Sir Humphry Davy, Henry Hickman, and Robert N. Collier. The story then continues with the observations and discoveries of Crawford W. Long, Horace Wells, W. T. G. Morton, and C. T. Jackson. In this and the succeeding part entitled "Controversy—the story of conflict," the author gives what is perhaps the most balanced account of the now famous (some may prefer the adjective infamous) ether controversy. In clear and incisive fashion Dr. Raper cuts his way through the welter of claims and counterclaims, making an honest and sincere effort to give each worker his just share of the credit. The final conclusion, which appears to be a most reasonable one, is that no *one* man can be called the true discoverer of anesthesia, but that Morton and Wells, jointly, come closest to meeting the criteria of having been the first to give ether anesthesia to the world. I believe that Dr. Raper has come as near as one may expect to giving a definitive answer to the question of priority in the discovery of ether anesthesia.

But this fascinating history does not stop at this point. In his fourth and concluding part the author goes on to tell a story no less interesting than that of the discovery of anesthesia. For he continues with an account of the development of modern anesthetics and the science of anesthesiology. Once surgical sleep became an acknowledged fact efforts were immediately made to find out how anesthetics acted, what the proper times and dosages were, and, of equal importance, what other substances besides ether and nitrous oxide could bring about insensibility to pain. This brings us right down to modern times with the development of local, spinal, rectal, and intravenous types of anesthesia, and the synthesis of new drugs effective by various routes and under special conditions.

Dr. Raper has told his story in a sprightly and even breezy fashion which should appeal to the wide audience that the book deserves, yet he has not neglected the scholar who wants his evidence. In a bibliographical appendix (the title-page of which is whimsically embellished with a vignette portraying two fighting cocks) the author gives a list of authorities consulted, with long quotations from their writings. This "critical bibliography" is followed by an excellent "general bibliography."

Finally, mention must be made of a group of illustrations, including many portraits of the chief actors in the drama, presented at the very beginning of the book preceding the text.

MORRIS C. LEIKIND

FREDERICK CLAYTON WAITE. *Western Reserve University Centennial History of the School of Medicine.* Cleveland: Western Reserve University Press, 1946. 588 pp., illustrated.

THIS volume is the most comprehensive and authoritative publication on medical history to be presented by a Cleveland author since 1889 when H. E. Handerson translated *Outlines of the History of Medicine* by J. H. Baas. From 1901 to 1940 Dr. Waite was professor of histology at Western Reserve University, teaching a subject requiring accurate observation of minute details. He applied this mental discipline to the analysis of an abundance of historical material on medical education which he had accumulated. All this information he carefully tabulated, and whenever authenticity was uncertain he spared no inconvenience to document it.

From this extensive historical collection Dr. Waite has prepared many lectures and papers. *A History of Western Reserve University* and the *History of the School of Dentistry of Western Reserve University* are two of his earlier books. Recently he published from collateral material a delightful volume on *The Story of a Country Medical College* in Vermont.

With such equipment it was eminently fitting that on the occasion of the centenary of the medical school at Western Reserve University, Dr. Waite should write its history. At the request of colleagues on the faculty and members of the alumni, he accepted the task as a command performance. All were anxious to have the collected material made available in book form, but war conditions and

other contingencies presented difficulties. With his retirement from active teaching he secured leisure to complete the book.

This history of the medical school is essentially a reference work, but because of references to other schools and various conditions durings its own development, it is of value to students of medical education in any part of the United States. On the very day that this book arrived the reviewer was able to assemble from it the necessary historical data regarding education that had been requested in preparation for the one hundredth anniversary celebration of the Ohio State Medical Association. It also contains much source material that will prove useful to those seeking similar historical information for other states.

In the background of the founding of the medical school in Cleveland as well as in crises that occurred during its development, there were many experiences comparable to those of contemporary schools elsewhere. The bitter strife between proprietary schools and those connected with universities, between the regular schools and those of the cults, was so acrimonious that probably another generation must pass before all the facts can be related. Dr. Waite has touched on some of this rivalry, but has wisely avoided controversial subjects.

Three chapters are devoted to pioneer medical education in the United States. One of these chapters contains a review of the various medical colleges that existed in the United States before 1801. Dr. Waite's descriptions are often dramatic, especially when he describes methods of obtaining material for the teaching of anatomy.

The organization of faculties, the timing of courses, the peripatetic teacher, all required cooperation, diplomacy and strategy. It was not uncommon for a whole group of teachers to secede and set up a rival school. This occurred not only in proprietary schools, but even in Columbia College. On the other hand, some schools maintained small faculties. At Dartmouth College, for instance, one man, Nathan Smith, constituted the entire medical teaching staff for thirteen years, except for two earlier years when Lyman Spalding lectured in chemistry. The premedical training was of poor quality in most schools; but it is stated that in the eighteenth century sixty-five per cent of the medical graduates of Harvard College held the degree of Bachelor of Arts. The first medical degree in the American colonies was conferred by the General Assembly of Rhode Island and Providence Plantations in 1663. In June 1763, King's College in New York established a department for teaching medicine. New York was also the seat of the first medical college, the College of Physicians and Surgeons, which applied for a charter on March 12, 1807.

Dr. Waite tells of the many other medical schools in Ohio besides Western Reserve, the first being the Medical College of Ohio, established in Cincinnati in 1819. In 1830, the Worthington Medical College near Columbus began instruction in botanic medicine, popularly known as Thomsonian medicine, a cult based on the observation that "plants shoot upwards from the soil and are emblems of light and happiness." The Willoughby Medical College was founded in 1834, and by direct legal succession it ultimately became the College of Medicine of Ohio State University.

Dr. Waite traces the course of the Cleveland school from its founding as the medical department of Western Reserve College in 1843 to its centennial celebration in 1943 as the School of Medicine of Western Reserve University. Those hundred years were by no means years of peace. Many rival groups opposed to the university faculty from time to time set up new schools, only to have them absorbed later by the Reserve School.

Even the homeopathic schools were subject to repeated change, and for a time one such school admitted only women. The same rivalry existed among the homeopaths, and their schools changed title, faculty, and location even more frequently than the regular schools. Although many homeopathic schools have been instituted in Cleveland, gradually they have passed first to the State University at Columbus and ultimately they have been abandoned in Ohio.

The story of the Cleveland medical school is typical of the advance in medical education throughout the nation. Beginning with two terms of sixteen weeks, in which the same lectures were repeated each year, the courses were lengthened, the number of sessions increased, the faculty enlarged, more subjects taught, and standards of admission raised. Finally, as a strong arm of the University, it has developed into a graduate school.

Medical teachers in other schools will find related in this book many experiences to parallel their own. The book portrays the rise of standards in medical teaching during the past one hundred years.

Dr. Waite has the faculty of presenting the cold facts of history in an engaging manner, casually introducing a fragment of philosophy here and a bit of humor there. The eyes of medical historians will appreciate the use of 12-point type and enough illustrations to add variety to the text. As with his other works, the author has given documented references for his statements. The manuscript has been ably edited by Professor L. N. Richardson of the English department of Western Reserve University.

Western Reserve University Centennial History of the School of Medicine is recommended for the reference division of medical libraries and for the private libraries of physicians, educators, and historians who are interested in the progress of medical teaching.

HOWARD DITTRICK

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